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WT-569

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No. 21 of 70 copies, Series A

AD-A995-066

Report to the Test Director

TECHNICAL PHOTOGRAPHY

Operation Tumbler-Snapper

By

Herbert E. Grier

and

Staff

Classification (Cancelled) (Changed to UNCLASSIFIED)
By Authority of TID 1381 (SUPPL) 31 Dec 71
By [illegible signature] 15 Feb 72

Classification (Cancelled)
By Authority of Ltr. Rev. DNA/DOE
By L. Niles, Ch. ISCM 30 Oct 80

Edgerton, Germeshausen & Grier, Inc.
Boston, Massachusetts

April 1954

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October 22, 1954

ERRATUM FOR TUMBLER-SNAPPER PROJECT 12.1 REPORT (WT-569)

Owing to an error made in transcribing information furnished by Test Organization, J-Division, Los Alamos Scientific Laboratory, the Errata (September 30, 1954) for the above report contained an incorrect statement. The last correction listed should read as follows:

Pages 143 – 144, Appendix E:
Change unit in column heading of last column to read "meters/msec" instead of "meters/μsec."

U. S. Atomic Energy Commission
Technical Information Service, Oak Ridge, Tennessee

AEC, Oak Ridge, Tenn., A33497

September 30, 1954

ERRATA FOR TUMBLER-SNAPPER PROJECT 12.1 REPORT (WT-569)

Information received after this report had been printed and bound indicates that the following corrections should be made:

Page 6, Illustrations:
Delete "Fig. 3.21 Rapatronic Collimator."
Change "Fig. 3.22" to "Fig. 3.21."
Change "Fig. 3.23" to "Fig. 3.22."

Page 38, Section 3.5.2:
Change first and second lines in first paragraph to read: "field using the collimator"; delete first part of second line, "pictured in Fig. 3.21. This collimator was." (The revision will then read, "Focal lengths of the Rapatronic cameras were measured in the field using the collimator braced on a stand," etc.)

Page 43, Fig. 3.21:
Delete entire figure.

Page 44, Fig. 3.22:
Change to "Fig. 3.21."

Page 45, Fig. 3.23:
Change to "Fig. 3.22."

Page 46, last line in Section 3.6:
Change "Figs. 3.22 and 3.23" to read "Figs. 3.21 and 3.22."

Pages 143 – 144, Appendix E:
Change unit in column heading of last column to read "meters/sec" instead of "meters/μsec."

U. S. Atomic Energy Commission
Technical Information Service, Oak Ridge, Tennessee

AEC Oak Ridge, Tenn., A33488

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WT-569

This document consists of 155 pages
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Report to the Test Director

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ABSTRACT

For Operation Tumbler-Snapper, the technical photography accomplished by Edgerton, Germeshausen & Grier, Inc. (EG&G), Program 12.1, was as follows:

(1) Airdrops
- (a) Position of burst
- (b) Fireball pictures for yield
- (c) Ultrashort-exposure-time photography (still)—Rapatronic
- (d) Pictures for blast studies
  - Mortar-Jato
  - Gun puff
  - Rocket trail
  - Dust, preshock turbulence, light absorption, and mirage
- (e) Early cloud formation
- (f) Bomb light as a function of time
- (g) Cloud tracking (only for the shots detonated in Yucca basin)
- (h) Consultation on operation of EG&G Disc camera in the bombing airplane

(2) Tower Shots
- (a) Fireball pictures for yield
- (b) Ultrashort-exposure-time photography (still)—Rapatronic and Teletronic (shots 6, 7, and 8)
- (c) Gun puff (shots 5 and 8)
- (d) Early cloud formation
- (e) Bomb light as a function of time

The reader is referred to the Camera Data Sheets, Appendix A, for a condensed listing of the photography which was performed. Complete data are presented in the Film Data Sheets which, because of their bulk, have been issued separately from this report.* These Film Data Sheets list all data pertinent to cameras, lenses, films, processing, magnifications, and time scales, as well as comments on the content of the record.

Projection prints of the films were made and distributed to those requesting them, usually within a week after the detonation. In addition, a sound film illustrating and describing typical photographic data obtained during the airdrops has been issued. Appendix B is a summary of the films included in this film.

*Tumbler-Snapper, Film Data Sheets, Vols. I, II, and III, EG&G-OUT 1013, 30 October 1952.

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CONTENTS

[redacted]

CONTENTS (Continued)

ILLUSTRATIONS

[redacted]

ILLUSTRATIONS (Continued)

TABLES

[redacted]

TABLES (Continued)

[redacted]

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CHAPTER 1

INTRODUCTION

Photography was accomplished from four types of stations. The cloud tracking was done from two manned stations located some 25 miles from zero. The dust, preshock-turbulence, light-absorption, and mirage studies were primarily obtained from a series of stations located 200 ft off the blast line and opposite even-numbered blast poles. These stations were concrete cubicles into which a camera rack containing two cameras was inserted from the top. This access hole was sealed with a lead block. One side of the station was provided with a lead-glass window through which the pictures were taken. The cameras in these so-called "dust" stations were only about 3 ft above ground level. In an effort to provide continuing coverage after the dust caused by thermal radiation and shock arrival had obscured the field of view of these cameras, it was decided to operate a few cameras from elevated structures. The three outermost dust stations had steel pipes mounted in their roofs on the top of which a camera was operated (approximately 14 ft above the ground). In addition, use was made of two of the 25-ft towers which had been originally built by the Department of Defense (DOD) for Operation Buster-Jangle. The remaining photography was accomplished from phototrucks and phototrailers, package units that were prewired in Boston and positioned on concrete pads in areas that had been stabilized. These stations were from 2 to 3 miles from Ground Zero.

The details of location and operation of the above types of stations are given in Appendix C.

The reader is referred to the Edgerton, Germeshausen & Grier, Inc. (EG&G), Operations Greenhouse[1] and Buster-Jangle[2] photographic reports for details on cameras, films, exposure calculations, processing and analysis methods, and general operational philosophies.

REFERENCES

1. Ball-of-fire Observations, Greenhouse Report, Annex 1.4, WT-101.
2. Technical Photography, Buster-Jangle Project 10.3 Report, WT-417, December 1952.

[redacted]

[redacted]

CHAPTER 2

FILM HANDLING

2.1 PRESHOT PREPARATION

All unexposed films were stored at the Control Point (CP) building. For films that were to be used on an actual test, the following procedure was carried out. Starting on the afternoon of D−2 day, the films were removed from the storage refrigerators and allowed to come to thermal equilibrium before the seals were broken. Before loading into cameras, the following steps were taken:

1. An identification number was perforated into the film. This number consisted of five digits. The first two numbers indicated whether the film was to be used for calibration, dry runs, or actual tests; the 13000 series indicated the live runs for Operation Tumbler-Snapper. Since less than 100 films were exposed per shot, the third number was used to designate the particular test. (TS 1 to 5 were the 130-- to 134-- series, the misfire, TS-6, was the 135-- series, and TS 6 to 8 were the 136-- to 138-- series.) The last two numbers indicated in an approximate manner the use for which the film was being exposed. Owing to program changes this can never be adhered to very strictly, although it was found that an attempt at such a system was very useful to those dealing intimately with the handling and programing of the films.
2. Two exposures were placed upon the head of the film. One was a gray scale to be used for sensitometric control and evaluation; the second was an accurate graticule to be used for checking relative film shrinkage during analysis of the records The position of these exposures on the film had to be such that the region in question would not be light-struck during the camera loading and such that it would not interfere with the record.
3. The films were placed in the appropriate magazines, cassettes, cans, etc., and were carefully marked as to station and camera destination. The actual camera loading was done on the afternoon of D−1 day.

2.2 PROCESSING

All 16- and 35-mm black and white films, as well as sheet films (scope cameras) and glass plates (Rapatronics, phototheodolites, and survey cameras), were processed by EG&G personnel in the mobile unit set up in the CP area (Fig. 2.1). The $9\frac{1}{2}$-in. by 75-ft records from the K-17 cameras were processed by the Inyokern NOTS, and the 16- and 35-mm color films (Eastman Color Negative emulsion) were processed by Consolidated Film Industries—the 35-mm films at their Hollywood, Calif., laboratory and the 16-mm films at their Fort Lee, N. J., laboratory. The order of processing was such as to make the records for position of burst and for yield determination ready as soon as possible; the other records followed in a logical order dictated by consideration of necessary development temperature and the film size.

[redacted]

In running film through the processing machine, it is necessary to group the records according to the contrast or gamma desired. Consequently, each make-up spool for the processing machine contained only records on the same emulsion exposed through the same type color filter and for which the same gamma was desired. In addition to the sensitometric strip

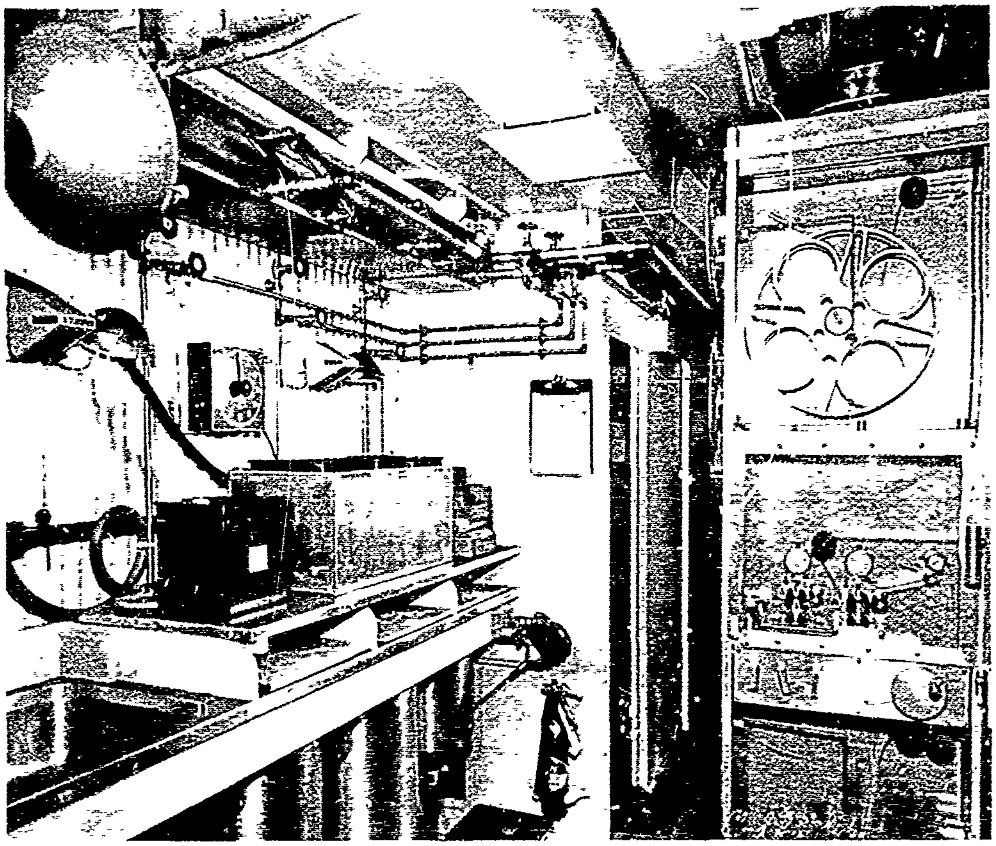

Fig. 2.1—Interior of EG&G phototrailer.

(gray scale) placed on the films themselves, additional gray scales were spliced into the head and tail of the make-up spool. These scales were read immediately after processing to provide constant check upon the acceptability of the development. Development Data Sheets were prepared in advance of the shot to be used as programing guides and to facilitate data recording. A typical data sheet of this type is shown in Fig. 2.2.

[redacted]

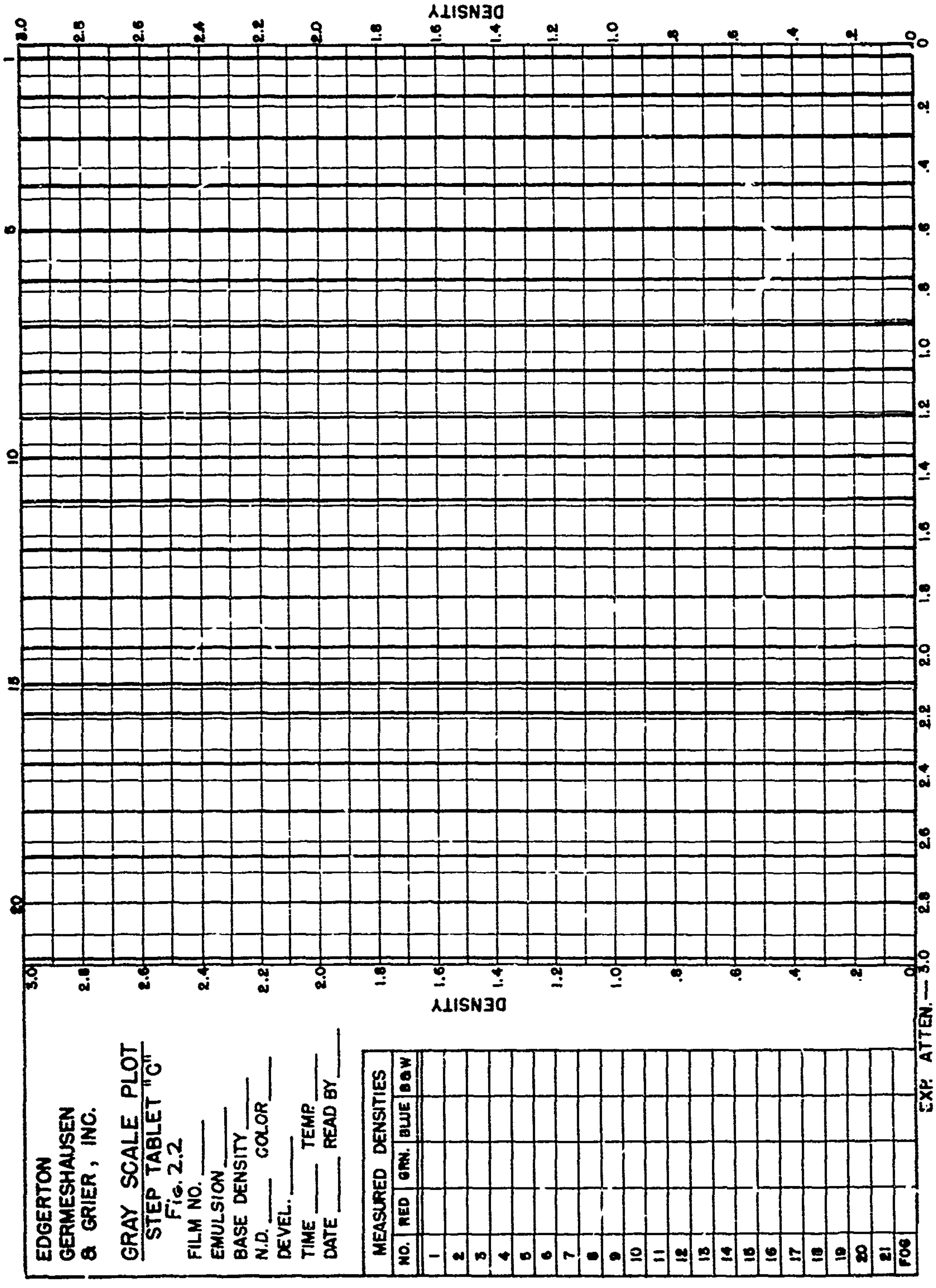

Fig. 2.2—Typical Development Data Sheet.

[redacted]

CHAPTER 3

FIREBALL GROWTH MEASUREMENTS FOR YIELD

3.1 METHODS OF SCALING

As in previous operations, EG&G used high-speed Eastman cameras and Rapatronic still cameras to determine yield. The methods of fireball scaling have been discussed at some length in reports for Operations Ranger,[1] Greenhouse,[2] and Buster-Jangle.[3]

It has been determined that, for bombs greater than about a 7-KT yield, the shock front expands at such a rate that, at a time prior to minimum, the variation of diameter with respect to time may be expressed as follows:

$$D = \phi t^{2/5}$$

where D = diameter of fireball

ϕ = a constant for all times at which the exponent of t equals 0.4

t = time in milliseconds

This may also be written

$$\phi = Dt^{-2/5}$$

The parameter ϕ assumes a constant value prior to the minimum on bombs of yield ≥ 7 KT. This allows the use of the scaling laws to determine yield.

It has been found more expedient to plot

$$\log \phi = \log t + K'$$

which is a more sensitive determination of the departures from the theoretical relation of $D = Kt^{2/5}$. The plots of log ϕ vs log time as applied to Tumbler-Snapper are shown in Figs. 3.1, 3.3, 3.5, 3.7, 3.9, 3.11, 3.13, and 3.15.

Thus, when the parameter ϕ assumes a constant value prior to minimum, it verifies the $t^{2/5}$ law and enables scaling of the bomb to determine the yield.

Method 1 of the Sandstone analysis, previously described,[2] compares the yield of a known bomb with that of an unknown bomb.

$$\frac{W_1}{W_2} = \left(\frac{D_1}{D_2}\right)^5 \left(\frac{t_2}{t_1}\right)^2$$

[redacted]

where W = yield

D = diameter of fireball

t = time at which the diameter is D

Combining these we obtain

$$\frac{W_1}{W_2} = \left(\frac{\phi_1}{\phi_2}\right)^5$$

Accounting for differences in ambient air density,

$$\frac{W_1}{W_2} = \frac{\rho_1}{\rho_2}\left(\frac{\phi_1}{\phi_2}\right)^5$$

By arithmetic averaging of the ϕ's obtained from Eastman records, a scaling equation may be written

$$W = K\rho\phi^5$$

From previous known bombs the value of K is found to be 1.294×10^{-8}.

Therefore, to obtain yield:

$$W = 1.294 \times 10^{-8}\rho\phi^5$$

where W = total energy release

ρ = air density of burst

ϕ^5 = (average value of diameter)^5 (meters) divided by (time)^2 (milliseconds) for all times of 0.4 slope

The above method was applied directly to TS 3 to 8. The resulting plots of ϕ's vs time and diameters vs time may be found in Figs. 3.1 to 3.18.

The first two bombs, TS 1 and 2, were of such low order as to forbid the use of the normal scaling laws. It was therefore necessary to compare the diameters obtained for these tests with those of Ranger A, also a low-order bomb (see Fig. 3.19).

The situation was hampered on TS-1 by the failure of the timing markers to operate. In this case, only Rapatronic camera records were used for measurement, since their absolute times were known. Comparison was then made of diameters obtained from these records and diameters determined from the Ranger A burst, giving a yield ratio

$$\frac{\text{Yield TS-1}}{\text{Yield Ranger A}} = 1.01$$

The same ratio determination was made for TS-2, using both Eastman and Rapatronic films for measurement. This method thus satisfactorily determines yield for small bombs, although reliability of the answer is only ±10 per cent.

3.2 LOCATION OF CAMERAS

The phototrucks and phototrailers were prewired in Boston and positioned on concrete pads approximately 2 miles from Ground Zero. These areas were stabilized to reduce the interference rendered by dust. On all shots at least two photostations were operated, roughly 90° apart, affording two distinct views for observation of the fireball growth.

Maps showing these various layouts of camera stations are presented in Appendix [illegible]

(Text continues on page 35.)

[redacted]

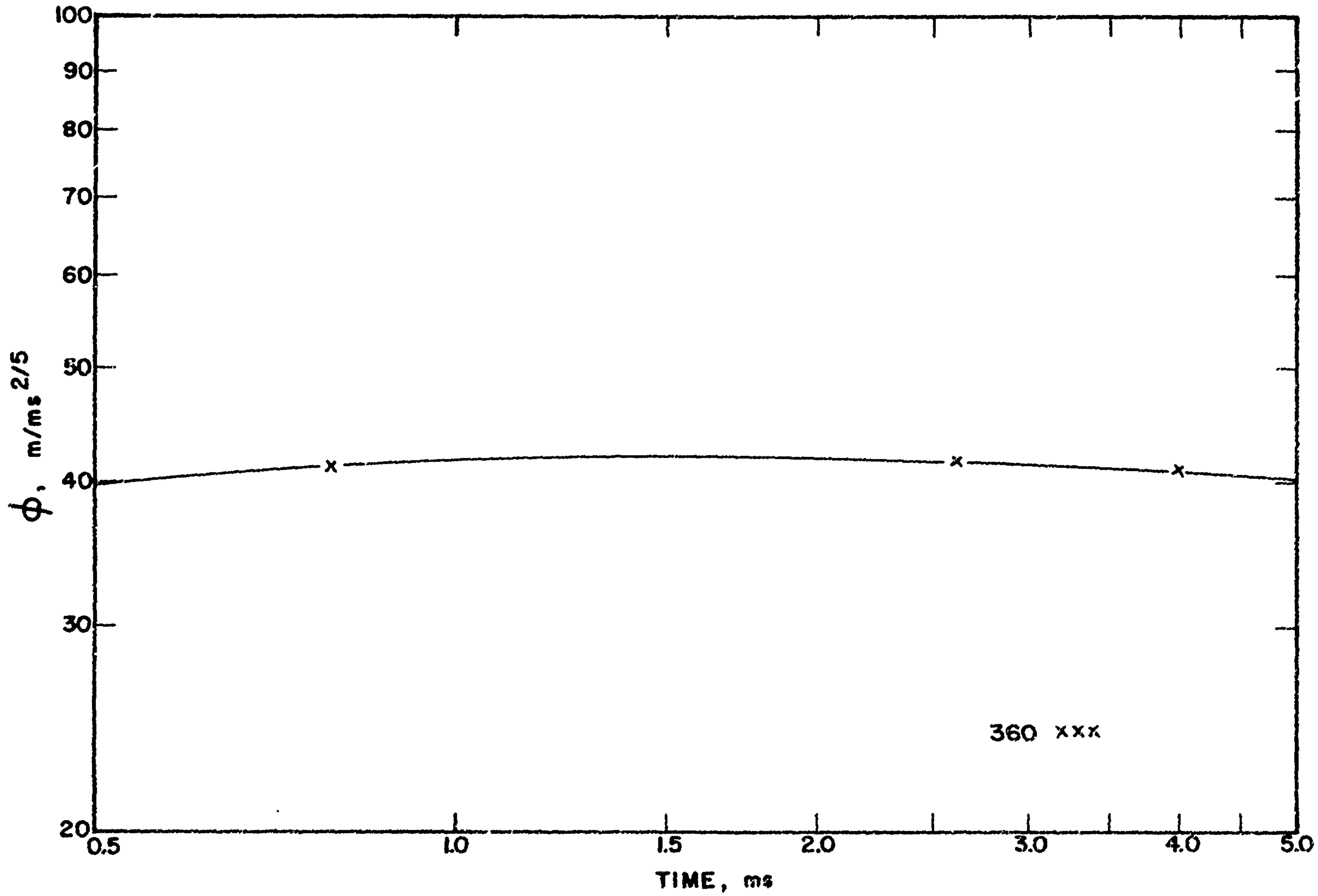

Fig. 3.1—TS-1 ϕ vs time.

[redacted]

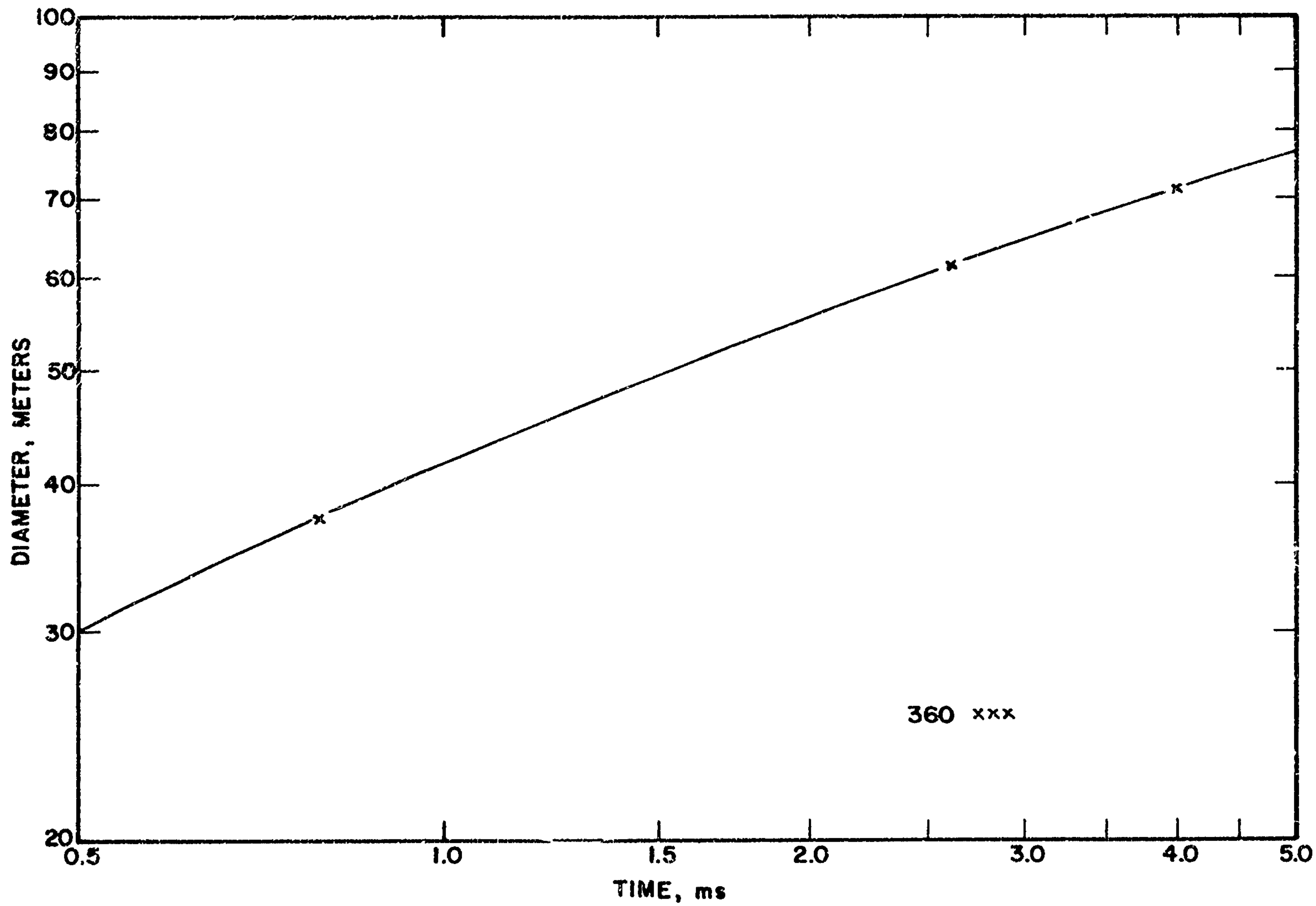

Fig. 3.2—TS-1 diameter vs time.

[redacted]

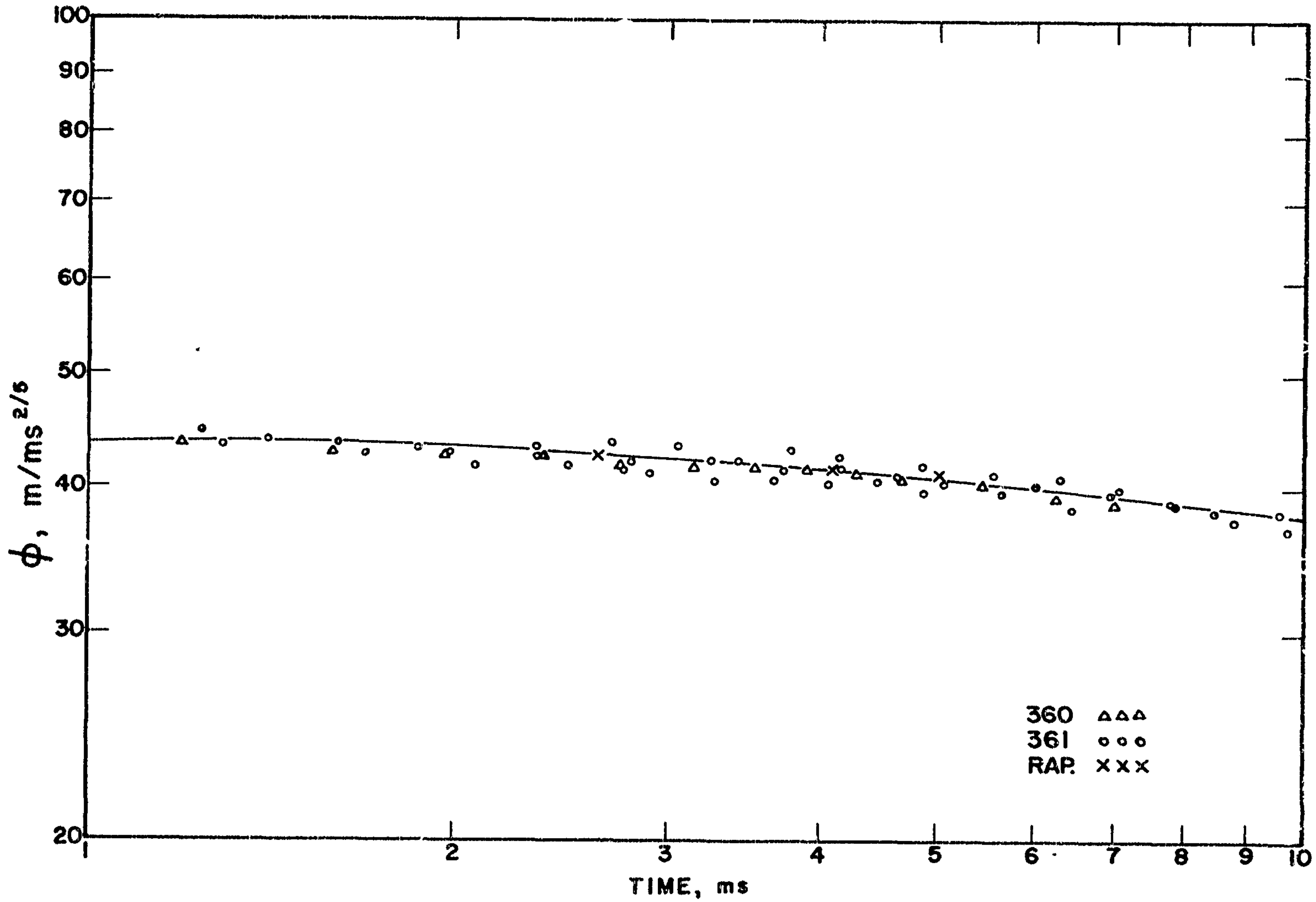

Fig. 3.3—TS-2 ϕ vs time.

[redacted]

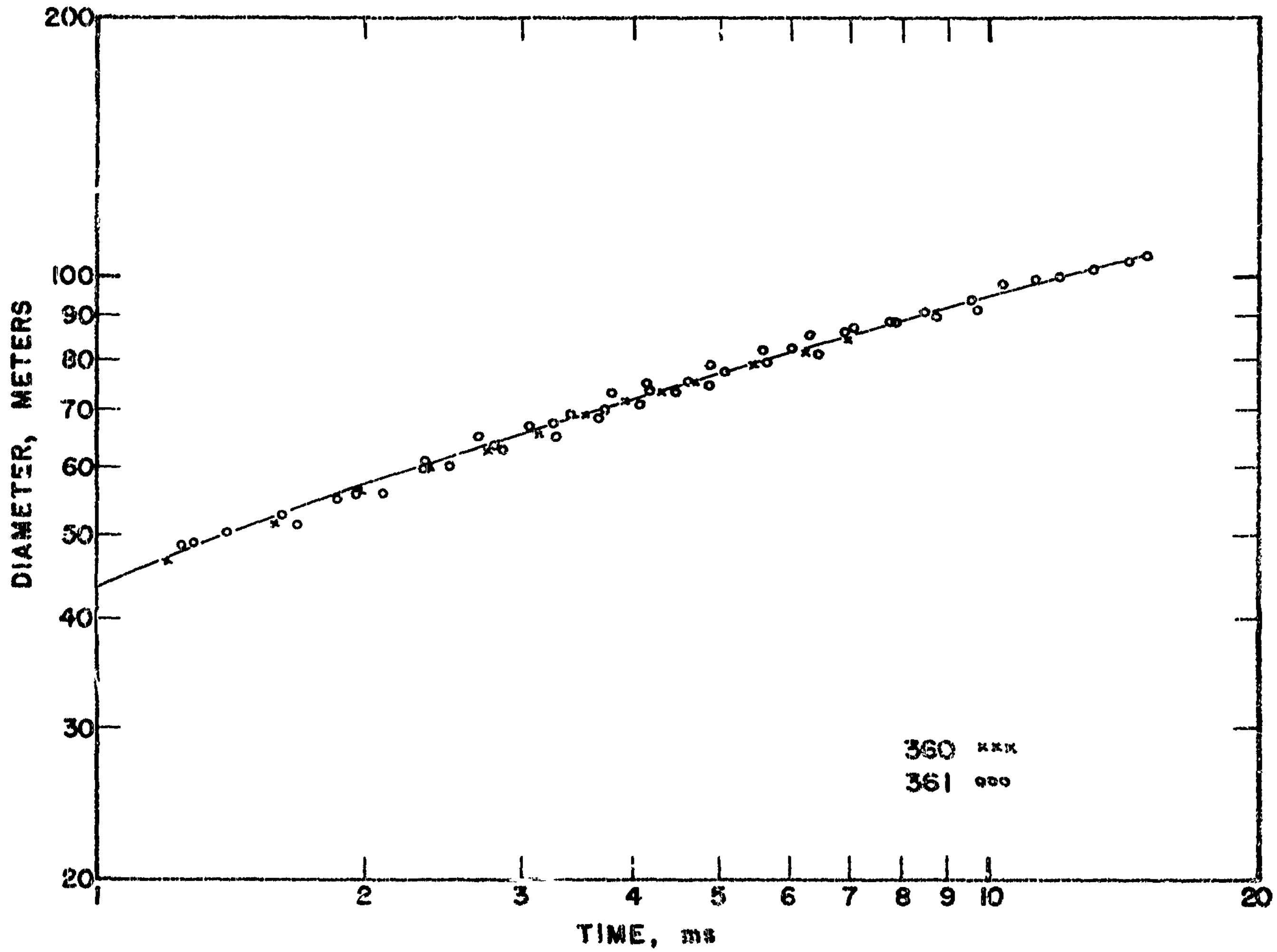

Fig. 3.4—TS-2 diameter vs time.

[redacted]

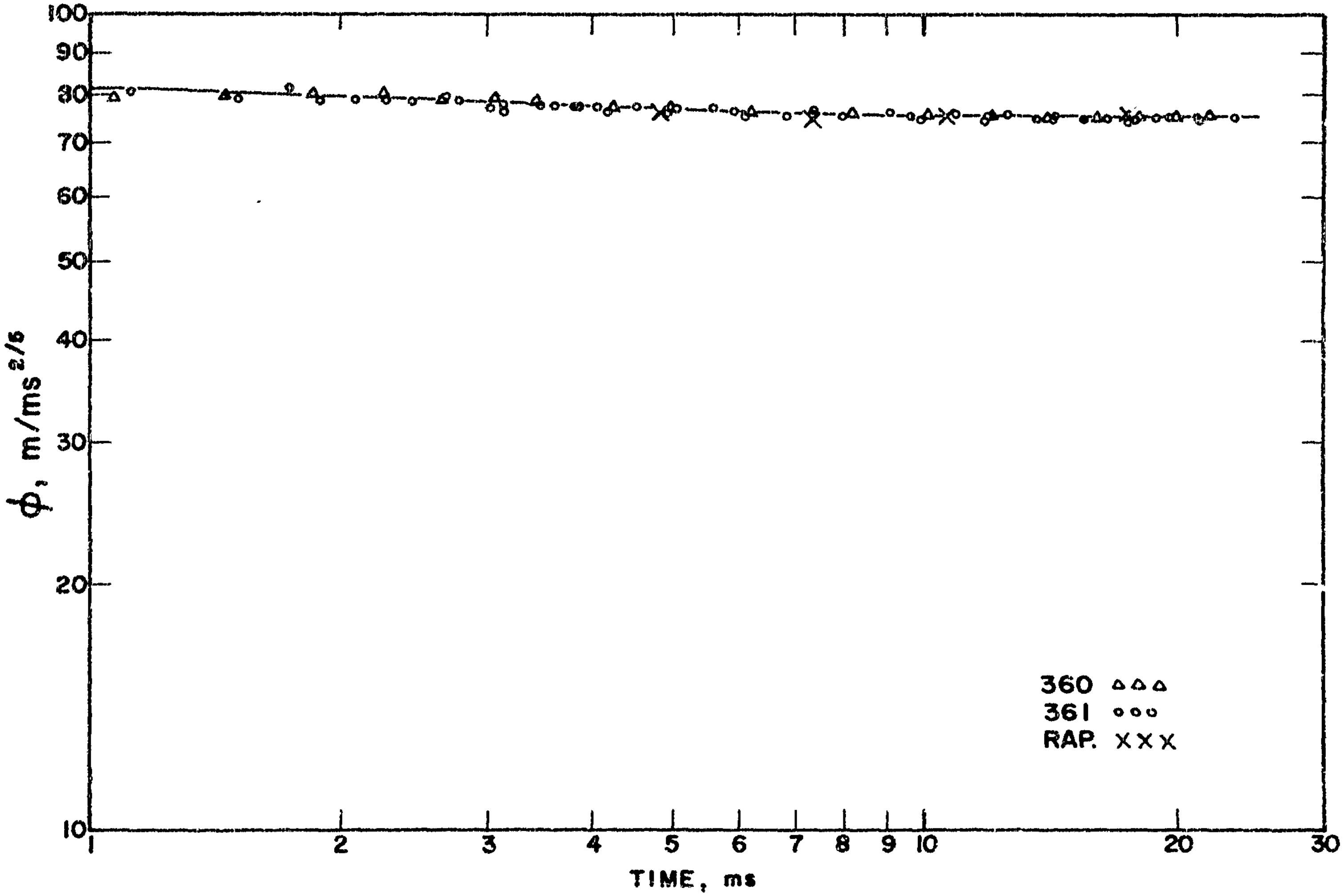

Fig. 3.5—TS-3 ϕ vs time.

[redacted]

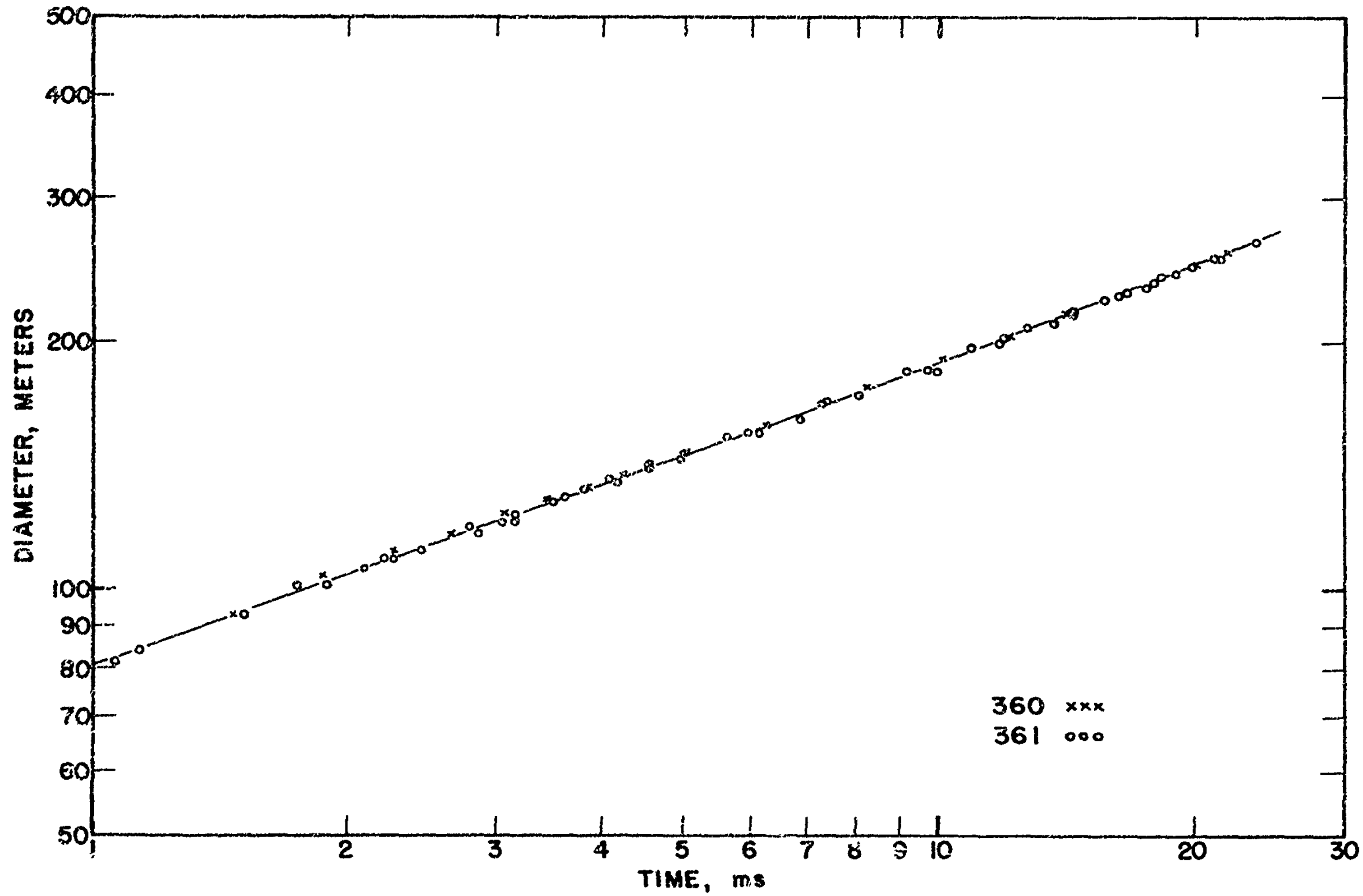

Fig. 3.6—TS-3 diameter vs time.

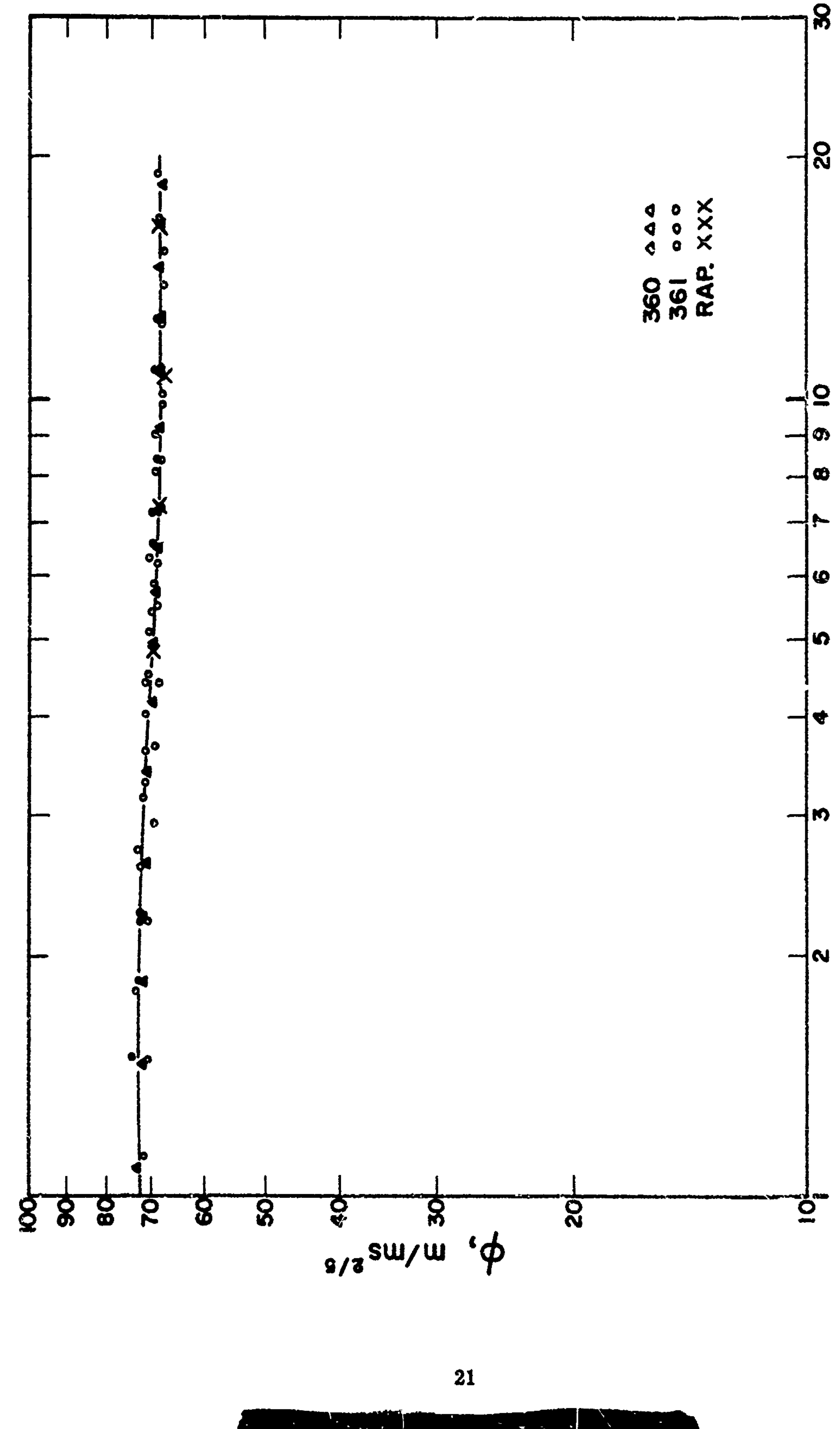

Fig. 3.7—TS-4 φ vs time.

[redacted]

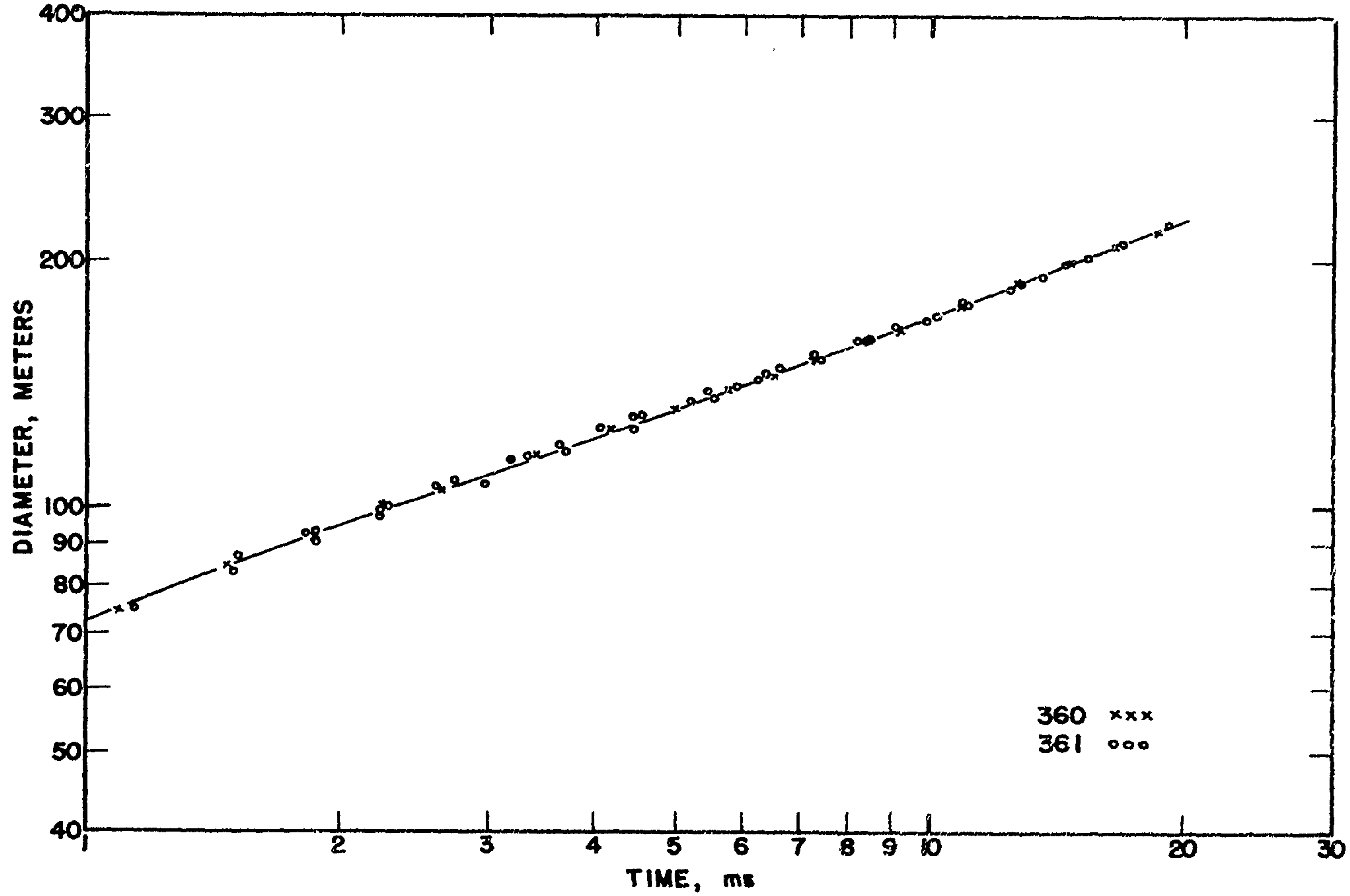

Fig. 3.8—TS-4 diameter vs time.

[redacted]

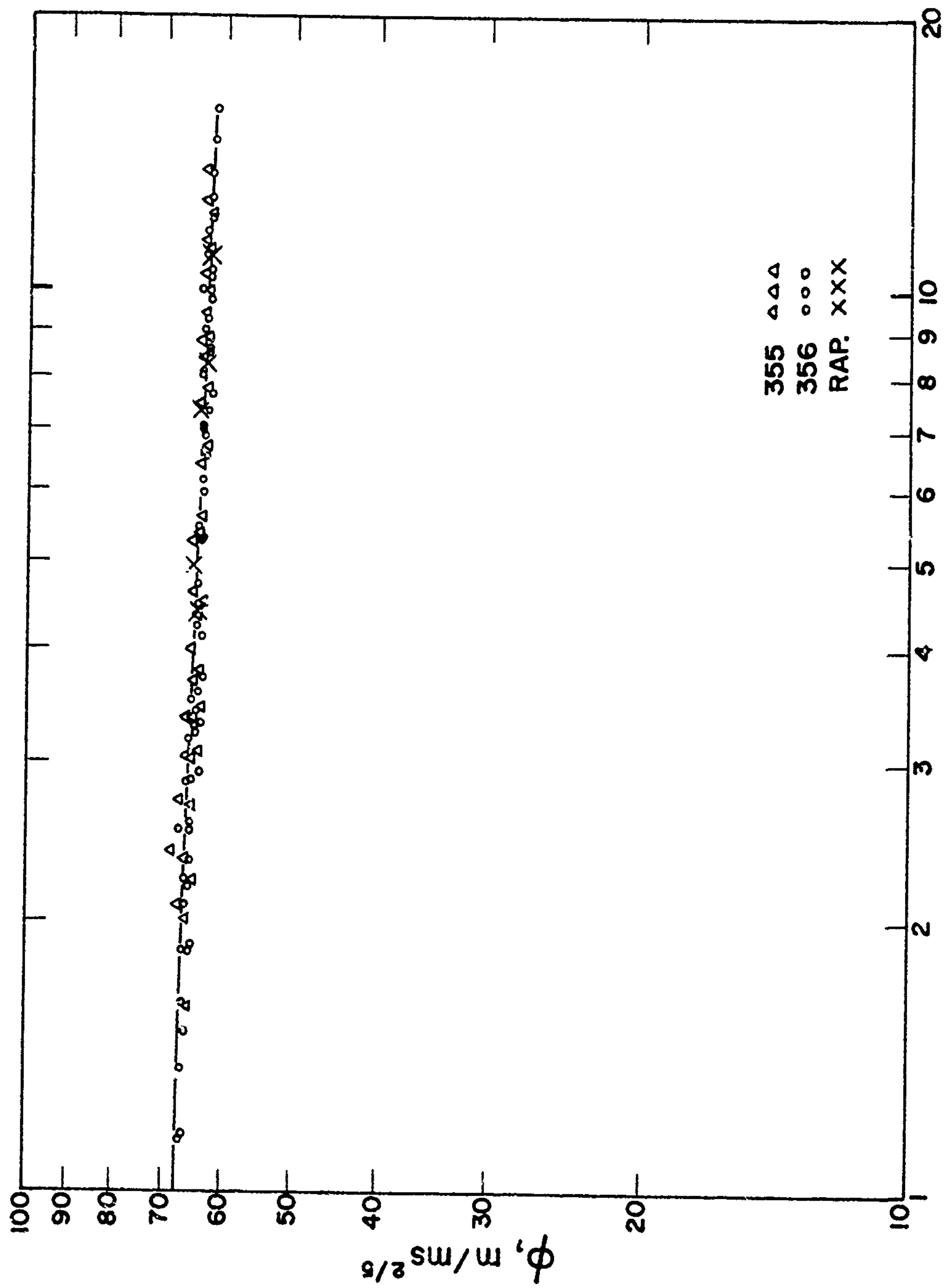

Fig. 3.9—TS-5 ϕ vs time.

[redacted]

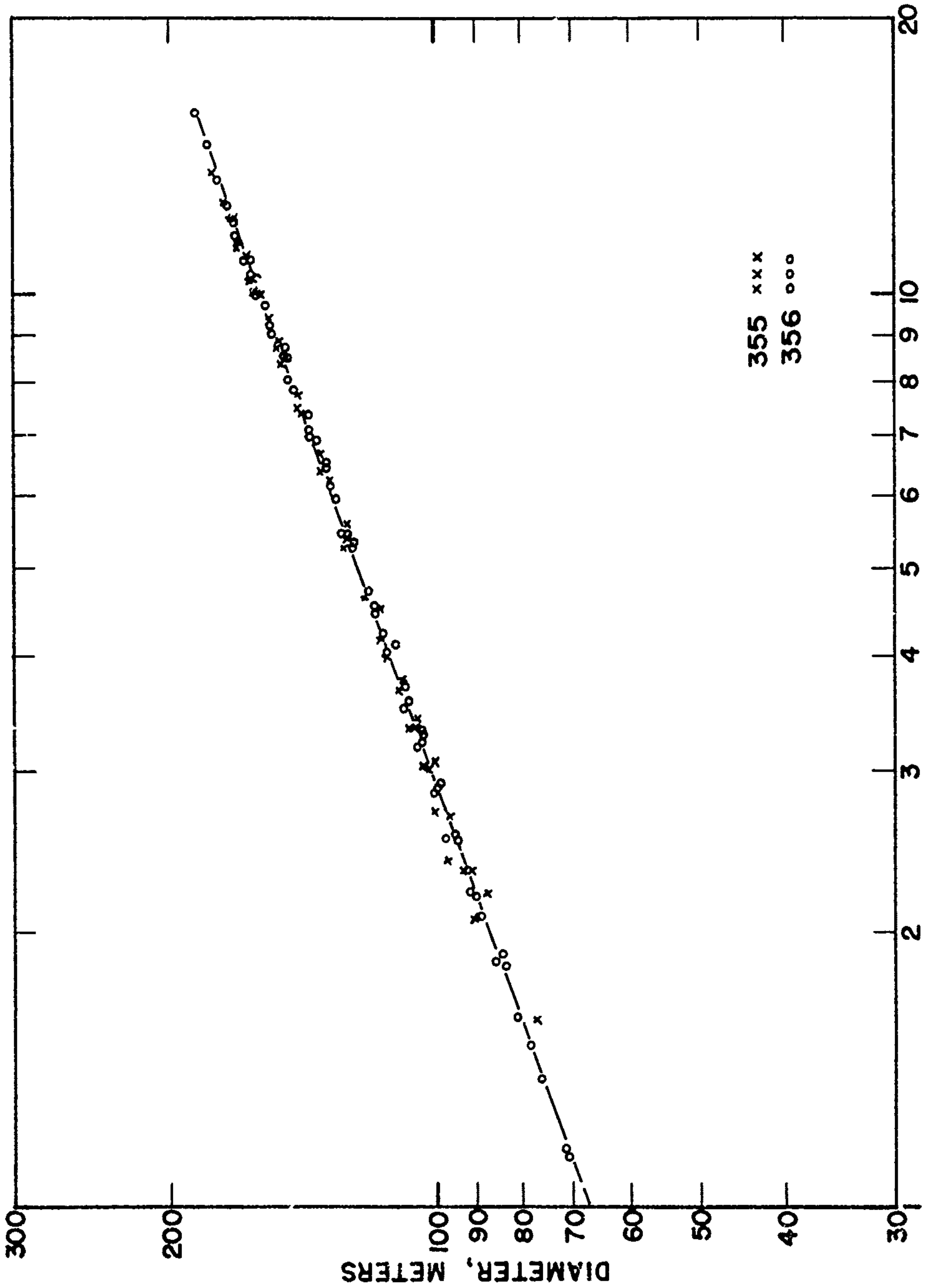

Fig. 3.10—TS-5 diameter vs time.

[redacted]

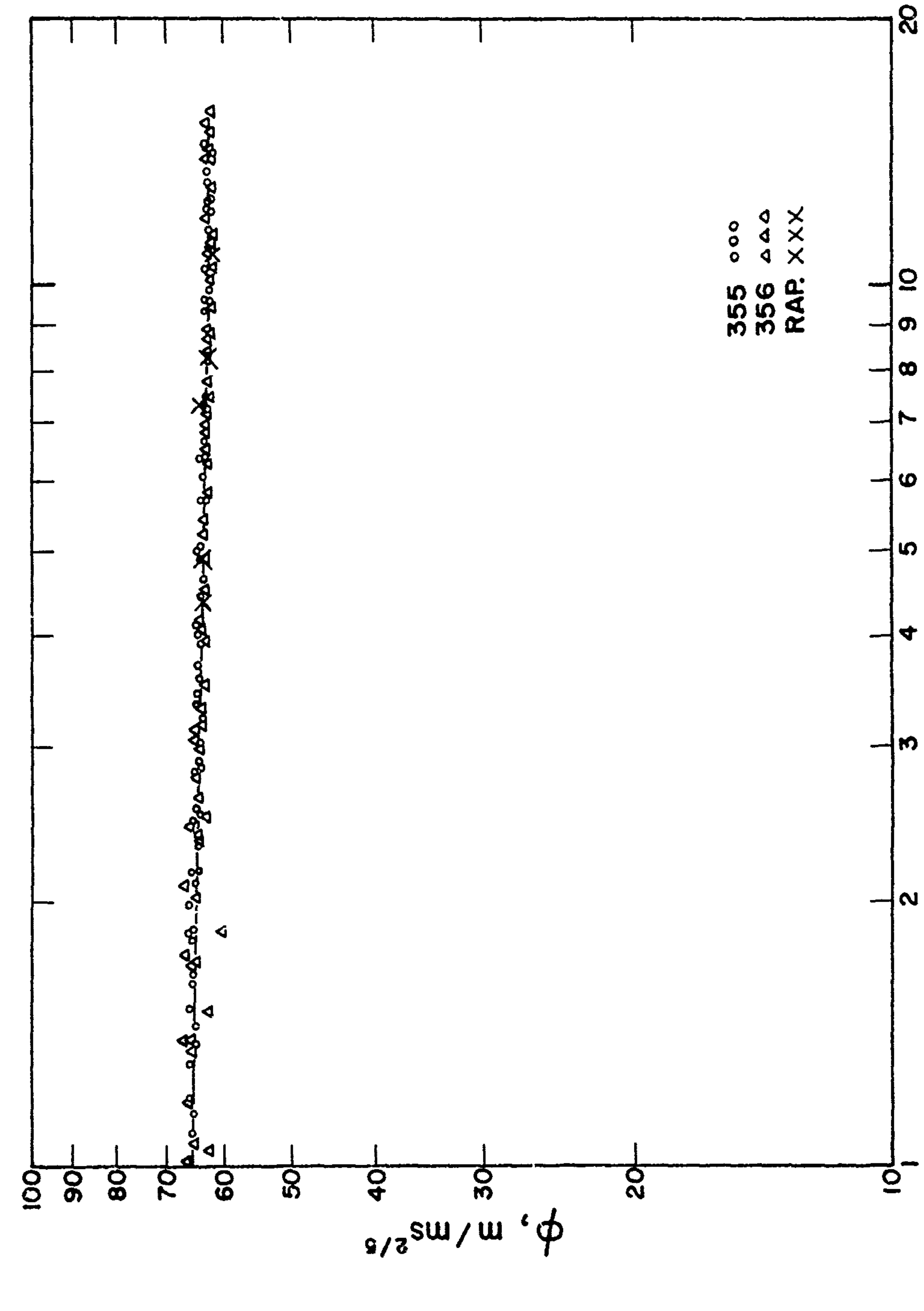

Fig. 3.11—TS-6 ϕ vs time.

[redacted]

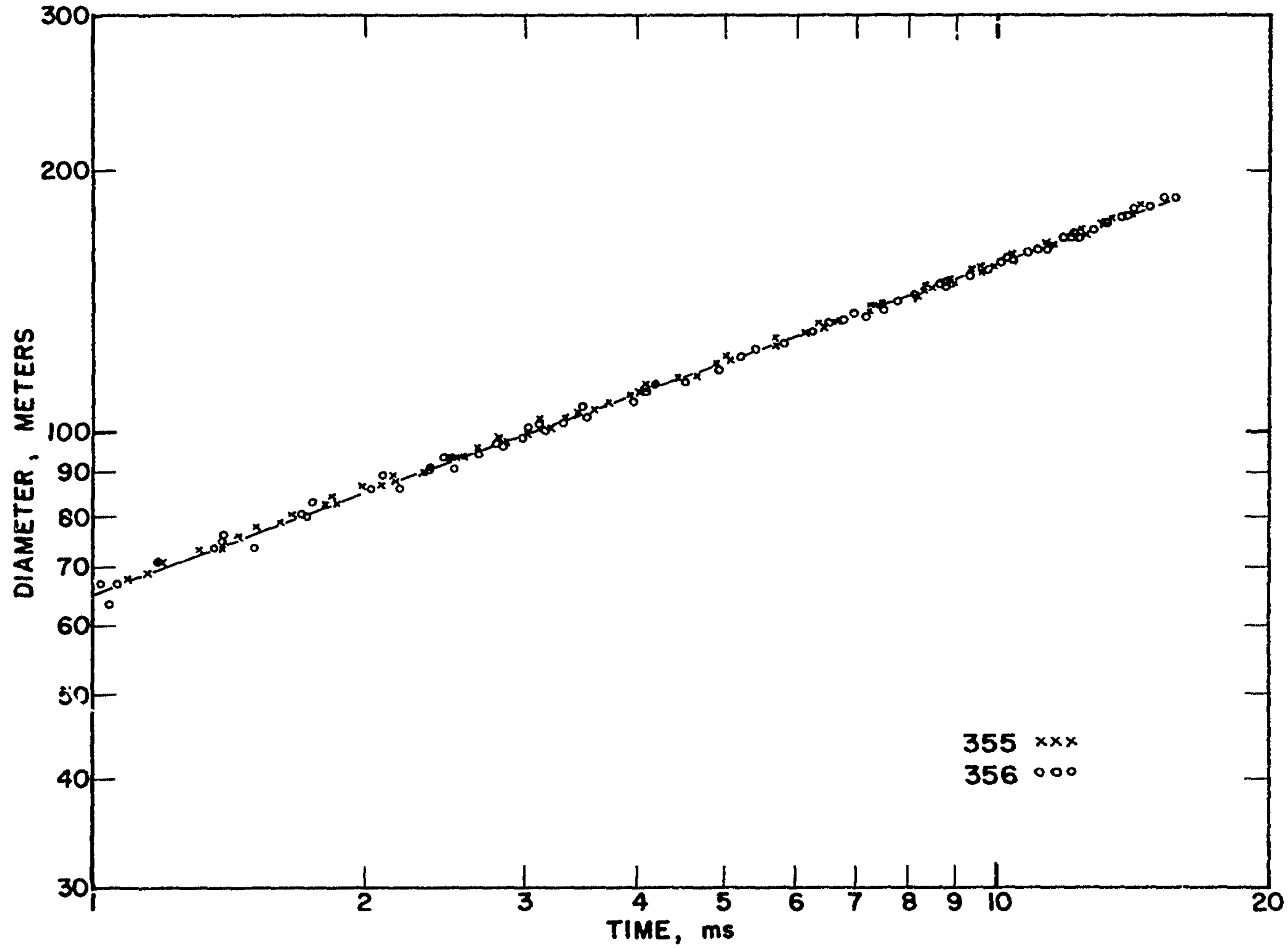

Fig. 3.12—TS-6 diameter vs time.

[redacted]

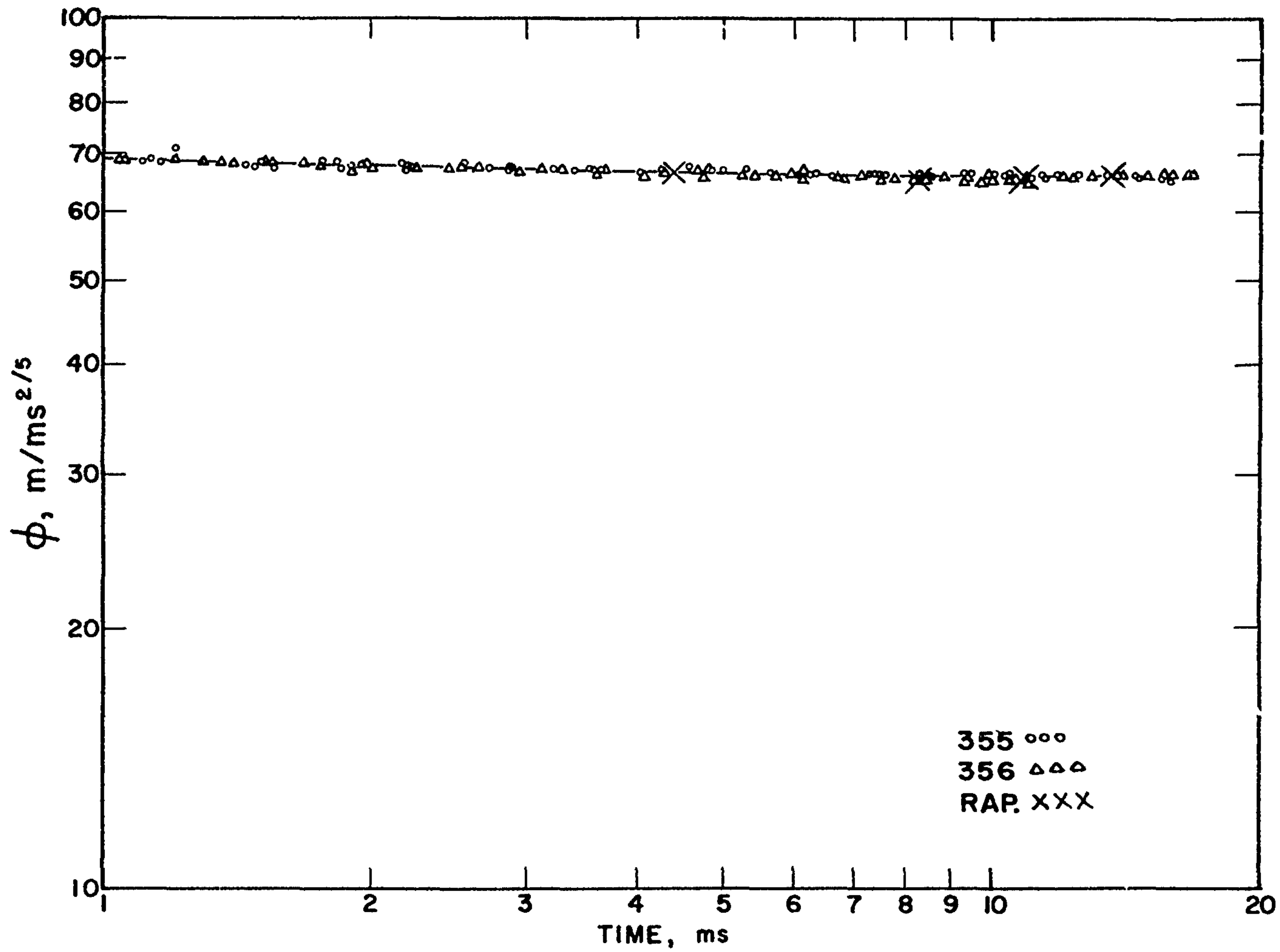

Fig. 3.13—TS-7 ϕ vs time.

[redacted]

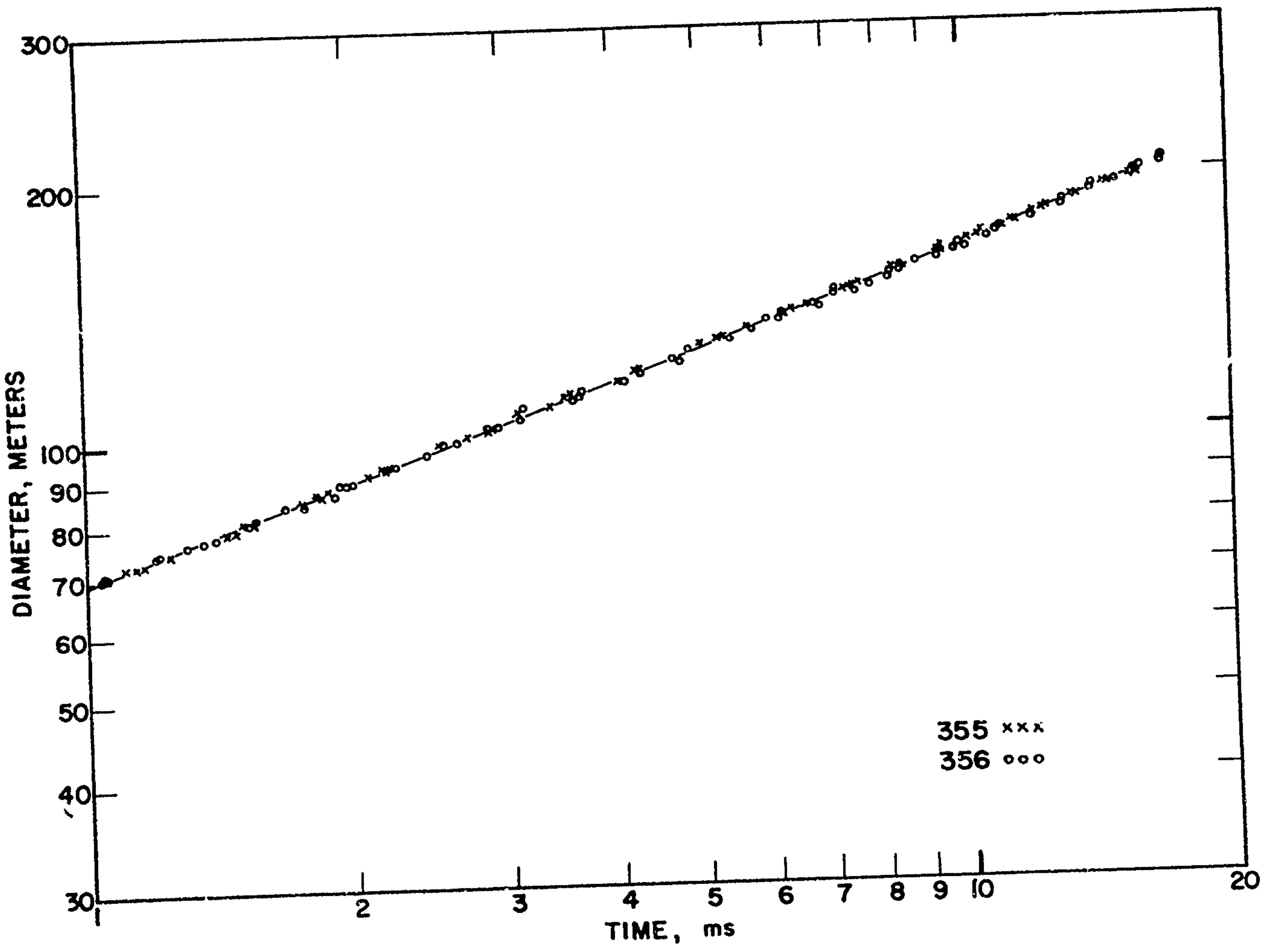

Fig. 3.14—TS-7 diameter vs time.

[redacted]

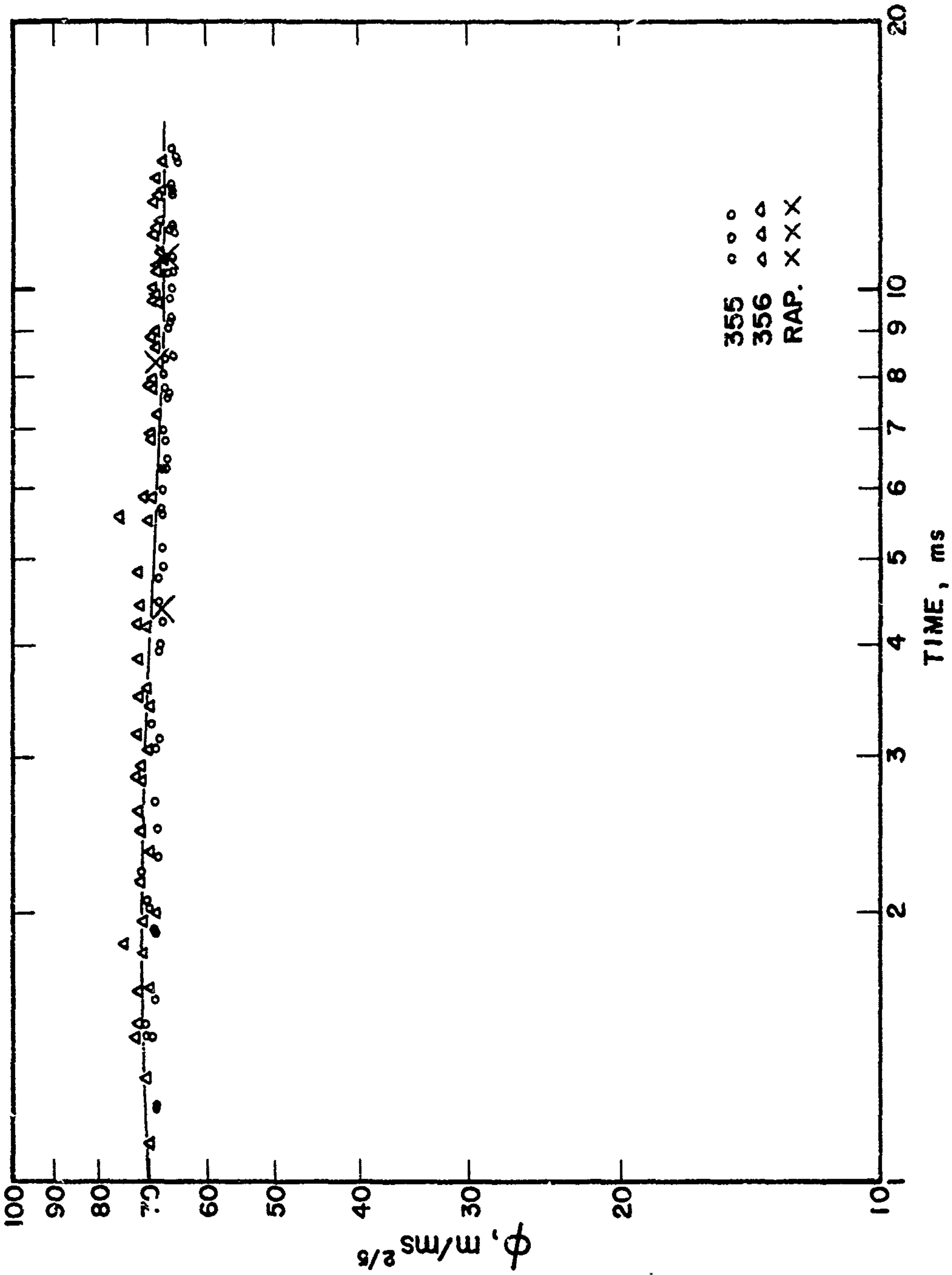

Fig. 3.15—TS-8 φ vs time.

[redacted]

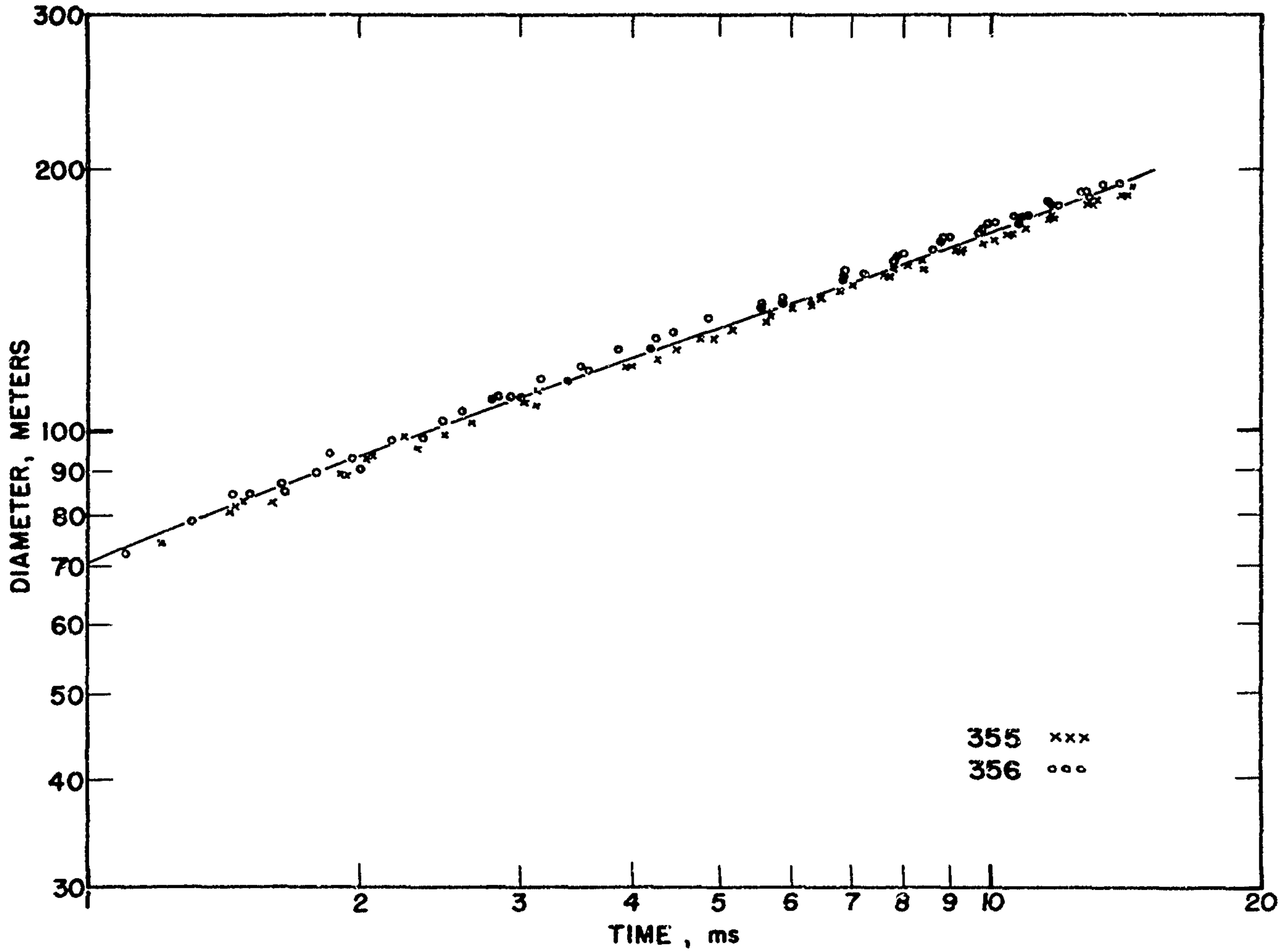

Fig. 3.16—TS-8 diameter vs time.

[redacted]

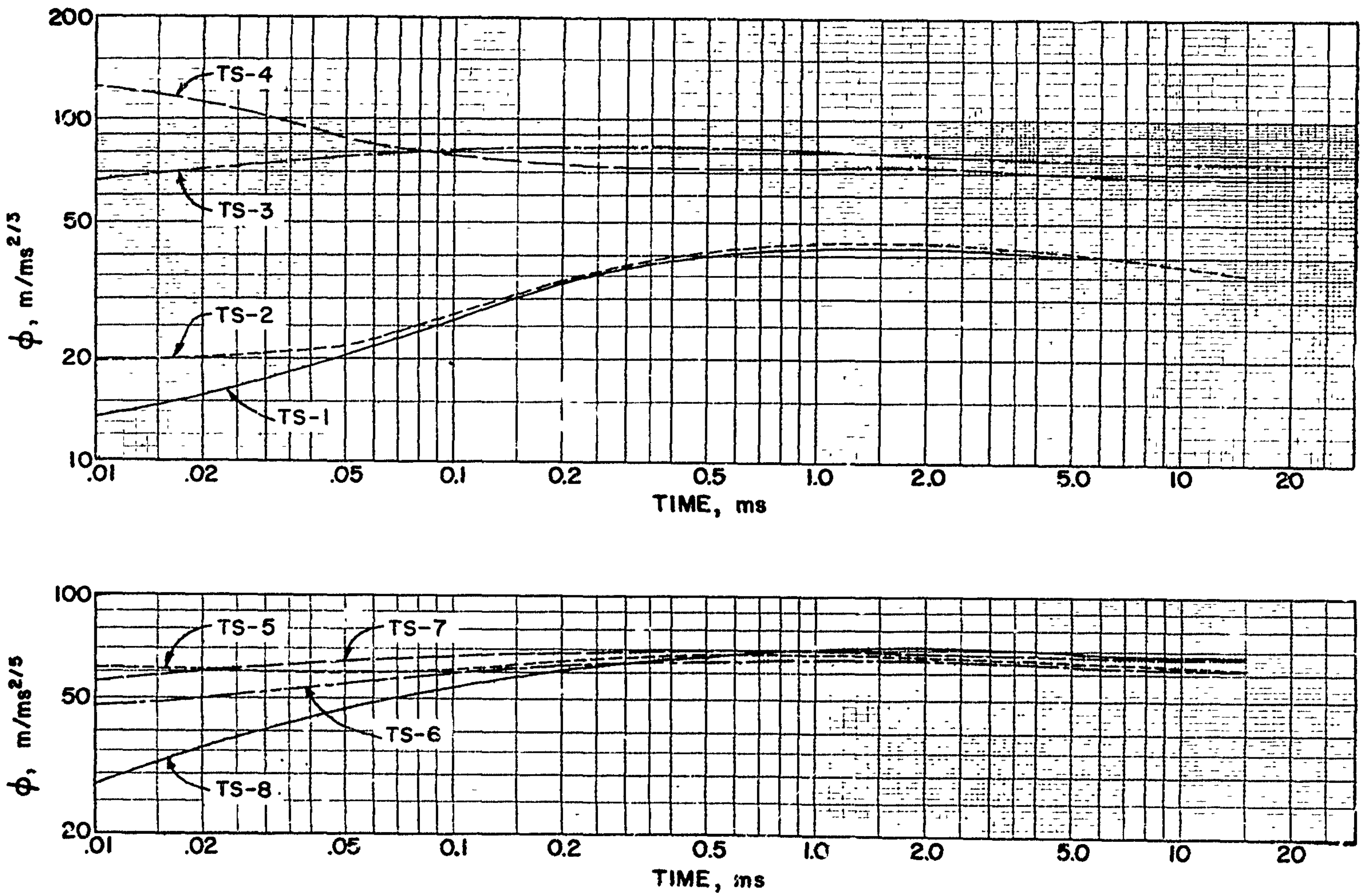

Fig. 3.17—TS 1 to 8 ϕ vs time.

[redacted]

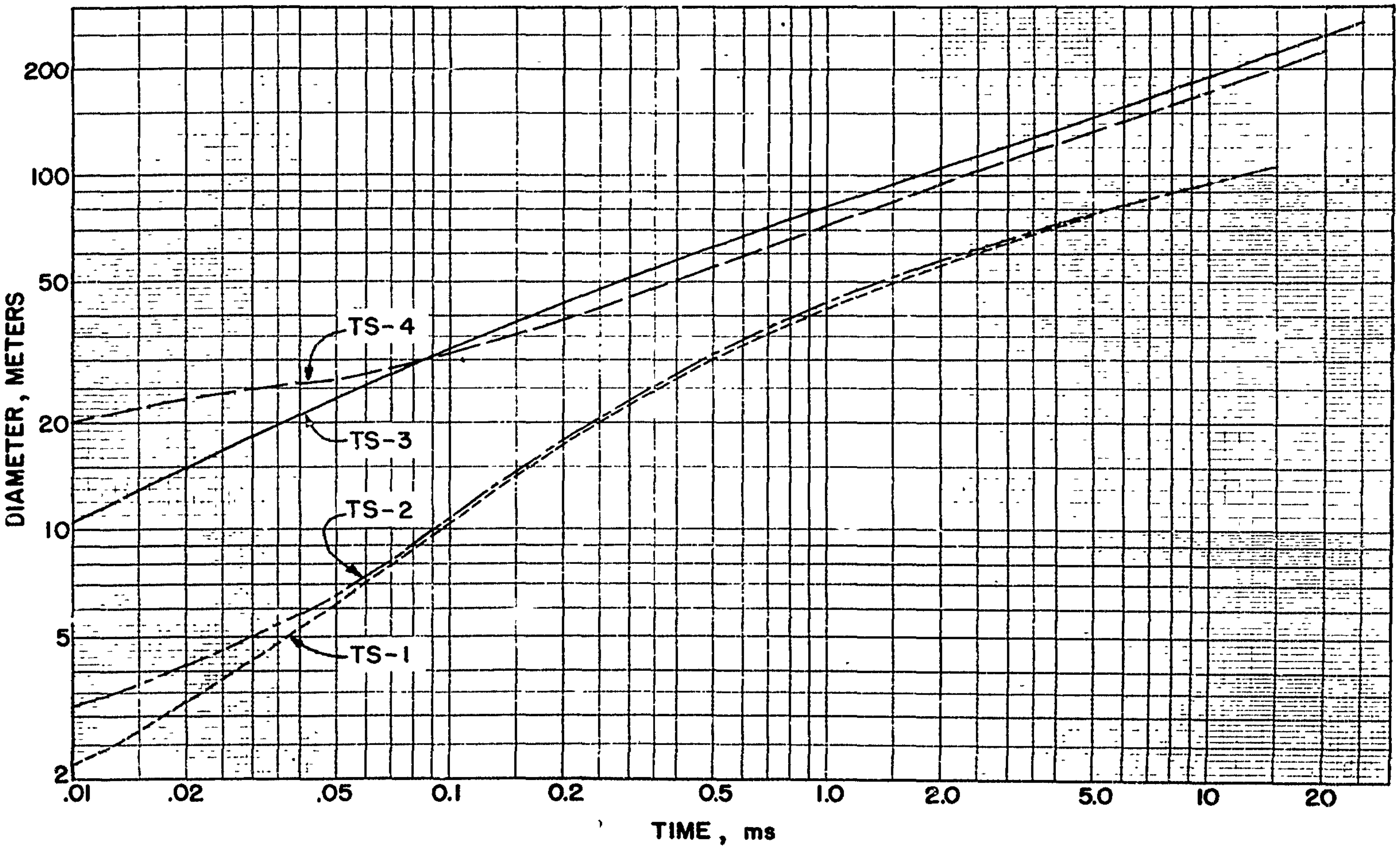

Fig. 3.18a—TS 1 to 4 diameter vs time.

[redacted]

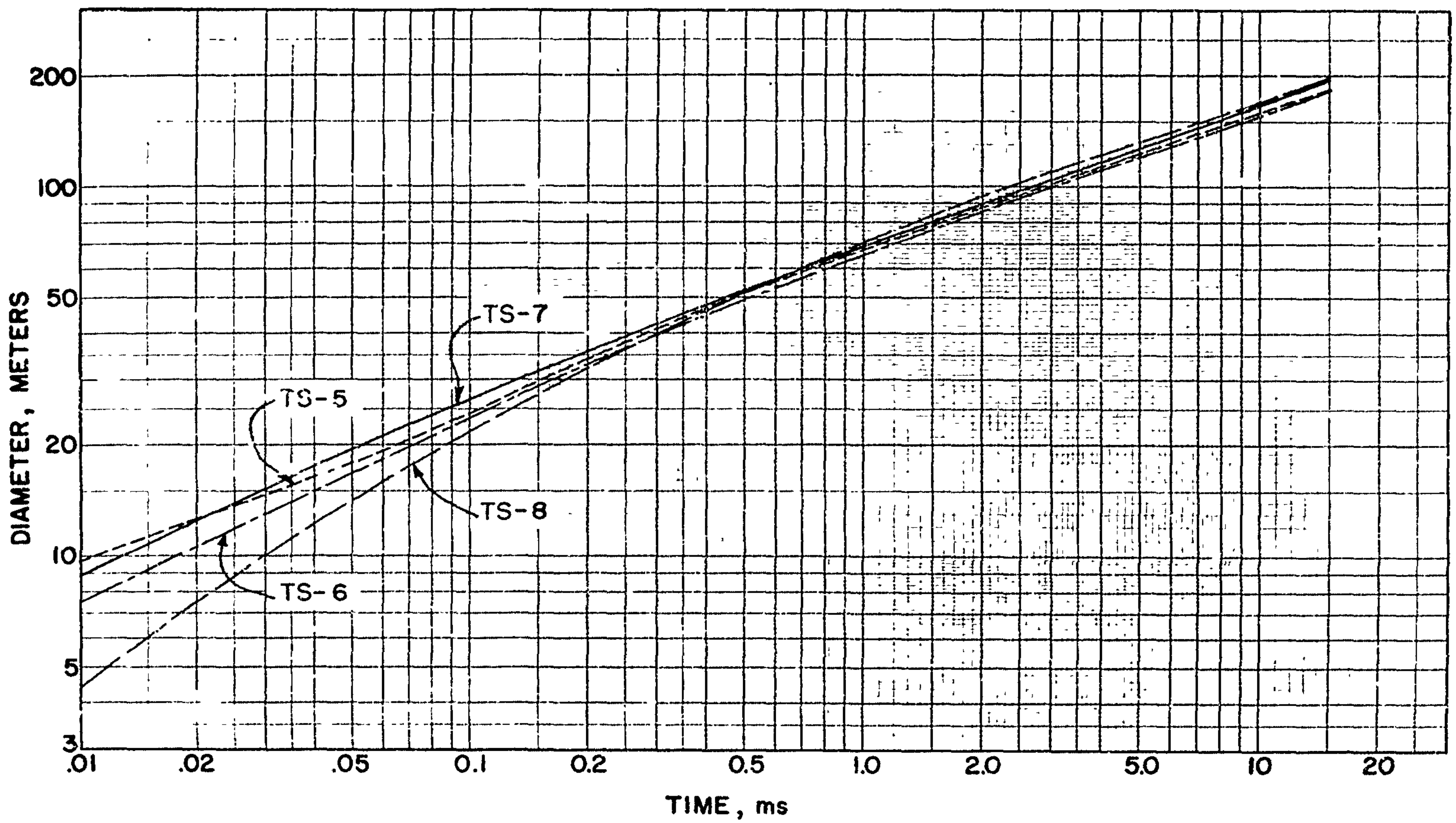

Fig. 3.18b—TS 5 to 8 diameter vs time.

[redacted]

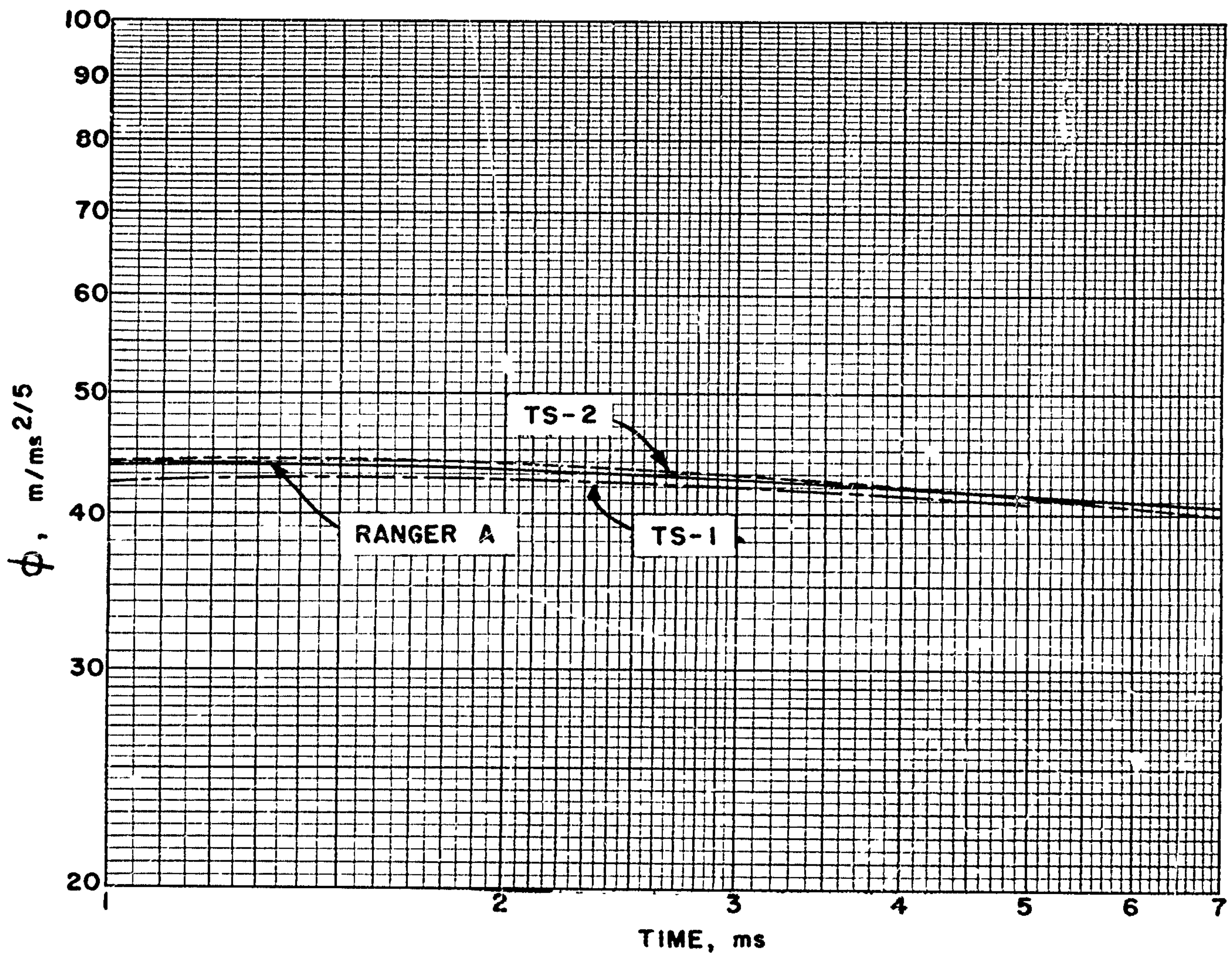

Fig. 3.19—Comparison of ϕ vs time on Ranger A and TS 1 and 2 (Eastman data).

[redacted]

3.3 PREPARATIONS

Before the operation, all cameras were collimated and the focal lengths were determined, as described in Appendix D. The films used for this purpose were exposed to constant temperature and relative-humidity conditions for several hours before being read. Likewise, all shot films were analyzed after being maintained under stable temperature and humidity conditions overnight.

3.4 EASTMAN PHOTOGRAPHY

The Eastman cameras were operated from the phototrucks as shown in Fig. 3.20. The films ran at between 2000 and 3000 frames/sec, the time scale being determined by a marker placing pips on the film at the rate of 200/sec. Use was also made of a fiducial mark placed on the film at zero time. A discussion of the methods of finding zero time and the time scale has been presented previously.[2] Data from all Eastman films read are summarized in Tables 3.1 to 3.3. Detailed calculations for the individual films have been issued as EG&G Report 1093, Tumbler-Snapper Fireball Data, EG&G-OUT 1177, 4 September 1953.

3.5 RAPATRONIC PHOTOGRAPHY

In addition to the 16-mm high-speed Eastman camera records, the Rapatronic camera served as an invaluable aid in the determination of yields.

The magneto-optic shutter allows an exposure time of only a few microseconds at a preset time. This then provides a sharp image of the shock front and fireball edge at a precisely known time. As many as 16 such cameras were used on each test, and the points obtained were weighted in with the points established by the Eastman records. These are plotted in Figs. 3.1 to 3.18, the Rapatronic points being plotted with X's. A summary of data from Rapatronic records is also presented in Table 3.4.

Not only were these points valuable as a check on the Eastman films but they also provided a much more accurate measure of diameters at early times, since the time resolution for an Eastman frame is of the order of 70 μsec and the Rapatronic 4 μsec and 40 μsec, depending on the shutter used. The 480-mm focal length allows a much larger image to be obtained, a distinct advantage at the early times. These large images at an early time also supply a means of determining the time of the "zero" frames on the Eastman records.

3.5.1 Eastman Zero-frame Time Determination from Rapatronics

From these early Rapatronic plates, time of the "zero" frame (i.e., the first exposed frame after detonation) on the Eastman films could be readily determined merely by a comparison of diameters. A graph of diameter vs time was drawn from the Rapatronic data. The first and second, and in some cases the third, Eastman frame diameters were measured. From the Rapatronic graph it was then easy to determine the respective times for these diameters. Since the velocity of the film was known, the zero-frame time could be obtained by subtracting from the time of each frame the corresponding time elapsed between it and the zero frame.

EXAMPLE: At times determined from Rapatronic diameter vs time graph.

Diameter at zero frame	25.5 meters at 0.125 msec
Diameter at 1 frame	46.2 meters at 0.435 msec
Diameter at 2 frames	57.7 meters at 0.720 msec

Subtracting elapsed time:

Frame 0	0.125 msec − 0.0 msec = 0.125 msec
Frame 1	0.435 msec − 1 (frame) × 0.3203 msec = 0.115 msec
Frame 2	0.720 msec − 2 (frames) × 0.3203 msec = 0.080 msec

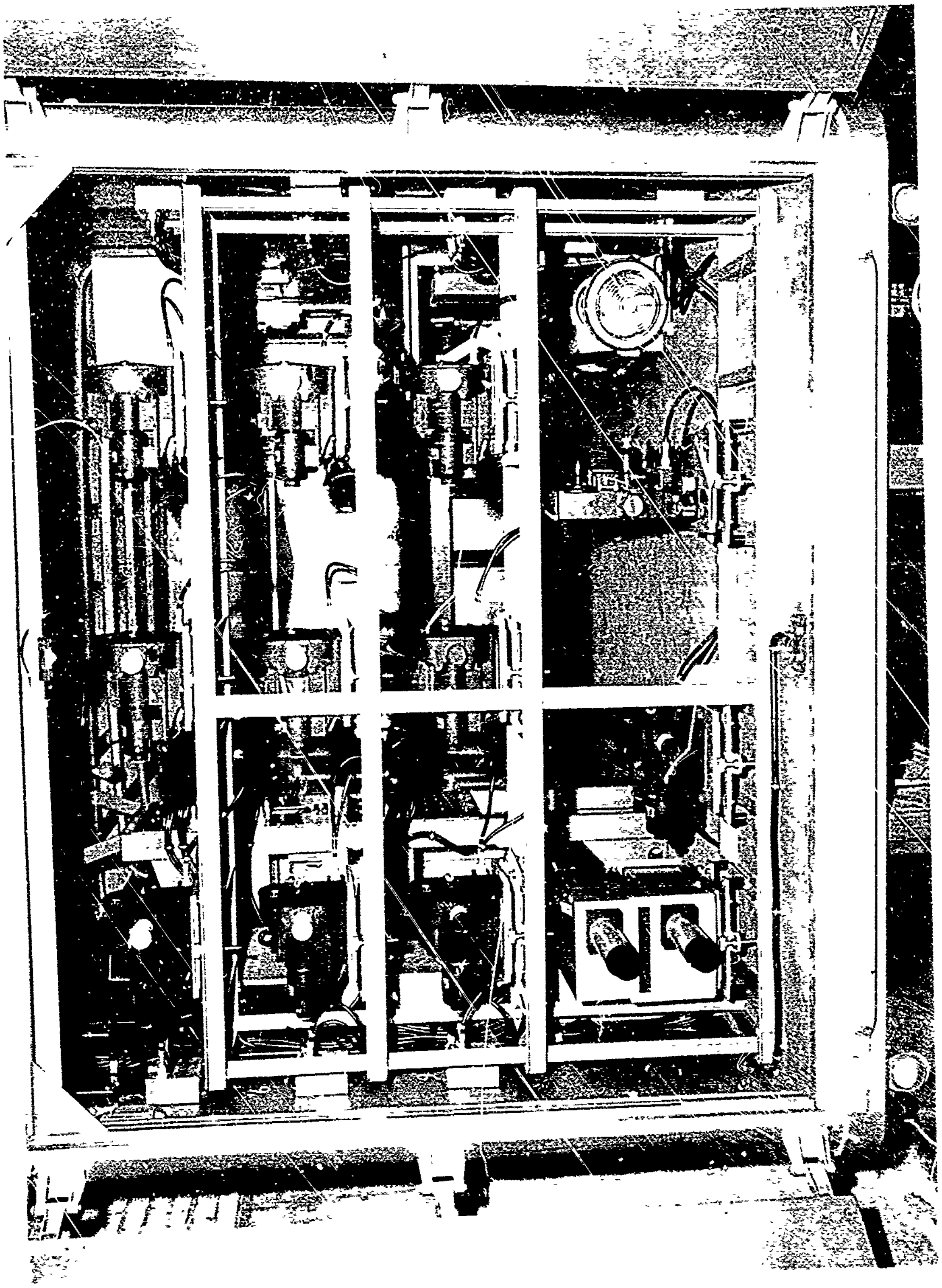

Fig. 3.20—EG&G phototruck —camera racks.

[redacted]

Table 3.1—SUMMARY OF EASTMAN DATA FOR FIREBALL

Shot	Film No.	Sta. No.	Total No. frames read	$\bar{\varphi}$	η	σ^2	σ
TS-3	13201	7-360	19	75.49	9	0.1243	0.3[illegible]
	13203	7-361	18	75.37	9	0.4272	0.654
	13205	7-361	16	75.25	9	0.2268	0.476
	13206	7-361	16	74.74	8	0.1442	0.380
TS-4	13301	7-360	19	68.63	11	0.4414	0.664
	13303	7-361	15	69.79	7	1.9274	1.388
	13305	7-361	16	69.26	11	0.6877	0.829
	13306	7-361	19	68.27	11	0.3874	0.622
TS-5	13400	1-355	13	63.[illegible]9	9	0.2479	0.498
	13401	1-355	14	63.66	8	0.2482	0.498
	13403	1-355	16	63.96	9	0.7655	0.875
	13404	1-356	15	63.19	7	0.5642	0.751
	13406	1-356	16	63.58	10	0.3330	0.577
	13407	1-356	15	62.96	15	0.4856	0.697
	13410	1-356	19	63.51	9	0.4195	0.648
TS-6	13600	4-356	21	62.30	12	0.1309	0.362
	13601	4-356	17	62.49	11	0.3135	0.560
	13602	4-356	19	62.59	8	0.5954	0.772
	13603	4-356	20	62.50	11	0.5604	0.749
	13605	4-355	16	63.13	11	0.3859	0.621
	13606	4-355	21	62.67	12	0.6072	0.779
	13607	4-355	18	62.93	10	0.3659	0.605
	13610	4-355	18	63.35	8	0.2588	0.509
TS-7	13700	3-355	18	66.24	10	0.0701	0.265
	13701	3-355	16	66.48	7	0.0231	0.152
	13702	3-355	20	66.13	9	0.1989	0.446
	13703	3-355	19	66.23	8	0.0745	0.273
	13705	3-356	16	66.19	9	0.0403	0.201
	13706	3-356	20	66.00	12	0.1476	0.384
	13707	3-356	18	65.93	8	0.0364	0.191
	13710	3-356	20	65.58	8	0.0669	0.259
TS-8	13800	2-356	16	68.82	8	0.2139	0.462
	13801	2-356	15	69.15	7	0.8615	0.928
	13802	2-356	15	67.81	8	0.5372	0.733
	13803	2-356	17	68.72	8	0.3453	0.588
	13805	2-355	12	66.21	8	0.2995	0.173
	13806	2-355	16	65.91	10	0.6756	0.822
	13807	2-355	13	66.20	7	1.0848	1.042
	13810	2-355	18	66.93	9	0.3923	0.198

The average of these times was then considered the best value for the time that the zero frame was exposed.

0.125 msec
0.115 msec
0.080 msec

0.320 msec or an average of 0.107 msec

Table 3.2—DIAMETER VS TIME DATA

Time	$t^{-2/5}$ ($msec^{-2/5}$)	Diameter, meters TS-1	TS-2	TS-3	TS-4	TS-5	TS-6	TS-7	TS-8
10 μsec	6.310	2.2	3.2	10.5	20.0	9.7	7.5	8.9	4.4
20 μsec	4.782	3.3	4.2	14.8	23.4	12.7	10.5	12.6	7.5
50 μsec	3.314	6.2	6.5	23.4	26.4	17.9	16.6	19.4	14.1
100 μsec	2.512	10.4	10.7	32.2	31.4	24.2	23.7	26.6	21.7
200 μsec	1.904	17.4	17.9	43.2	39.0	34.1	33.1	35.9	32.1
500 μsec	1.320	30.2	31.2	62.2	54.6	50.9	49.3	52.7	51.1
1 msec	1.000	41.9	43.6	81.2	72.5	67.2	65.3	69.3	70.3
2 msec	0.7579	55.4	57.4	104.6	95.5	87.6	85.5	89.7	94.0
5 msec	0.5253	76.7	77.1	145.4	132.3	123.0	120.5	126.6	131.4
10 msec	0.3981		94.9	189.1	170.8	158.2	155.7	166.1	168.3
15 msec	0.3385		105.8	222.5	200.9	183.2	183.2	195.3	197.9
20 msec	0.3017			249.6	225.4				
25 msec	0.2760			272.9					

Table 3.3—ϕ VS TIME DATA

Time	ϕ, meters/$msec^{2/5}$ TS-1	TS-2	TS-3	TS-4	TS-5	TS-6	TS-7	TS-8
10 μsec	13.6	19.9	66.3	126.4	61.0	47.5	56.3	28
20 μsec	15.7	20.2	70.8	112.0	60.8	50.0	60.2	36
50 μsec	20.6	21.7	77.7	87.5	59.3	55.0	64.3	46.7
100 μsec	26.2	27.0	80.8	78.8	60.7	59.5	66.7	54.4
200 μsec	33.2	34.1	82.2	74.3	64.9	63.0	68.4	61.2
500 μsec	39.9	41.2	82.1	72.1	67.2	65.1	69.5	67.4
1 msec	41.9	43.6	81.2	72.5	67.2	65.3	69.3	70.3
2 msec	42.0	43.5	79.3	72.4	66.4	64.8	68.0	71.3
5 msec	40.3	40.8	76.4	69.5	64.6	63.3	66.5	69.0
10 msec		37.8	75.3	68.0	63.0	62.0	66.12	67.0
15 msec		35.8	75.3	68.0	62.0	62.0	66.12	67.0
20 msec			75.3	68.0				
25 msec			75.3					

3.5.2 Collimation

Focal lengths of the Rapatronic cameras were measured in the field using the collimator ~~pictured in Fig. 3.21. This collimator~~ was braced on a stand on the ground at the rear of the vehicle containing the camera rack.

The collimator contains the target, which is a series of fine wires placed obliquely to the collimator focal plane. The middle wire is in the focal plane. The wires are then photographed by the Rapatronic, the wire in sharpest focus showing the point of infinity focus for the Rapatronic. The wires have been arranged so that each one represents a change of 0.01 in. in the Rapatronic focal length. By inspecting the photograph, the amount of adjustment necessary to bring the Rapatronic into best focus for infinity is easily determined. Positioning the focal plane to an adjustment of 0.01 in. results in very sharp pictures.

[redacted]

Table 3.4—SUMMARY OF RAPATRONIC RECORD DATA

					NAME				DATE		JOB NO.
					Filters						
Film #	Camera #	Station	Time (μs)	Emulsion	ND	Color	Eff. Aper.	Φ	Diam (m)	Remarks	
TS-1											
13041	R-9	F-361	100	MF	-	-	150	26.1	10 4		
42	R-33	"	403	"	-	-	150	39.1	27.2		
43	R-19	F-362	50	"	-	-	150	20.2	6 1		
44	R-18	"	212	"	-	-	150	33.9	18.2		
45	R-26	F-361	11	HRHS	-	-	150	13.4	2.2		
46	R-31	"	32	"	-	-	150	17.4	4.4		
47	R-24	F-362	2632	"	-	-	150	41.7	61.4		
48	R-4	"	18	"	-	-	150	16.1	3.2		
49	R-5	F-361	30	Ekta	-	CC40M	70			Color - Overexposed	
50	R-6	"	50	"	-	CC40M	70			" "	
51	R-12	F-362	36	ECP	-	-	70			" - no balance	
52	R-17	"	80	"	-	-	70			" " "	
53	R-8	F-361	5040	Tri X	-	-	150	40.3	77.0		
54	R-10	"	4000	"	-	-	150	41.1	71.6	*	
55	R-14	F-362	3000	"	-	-	150		-		
56	R-29	"	180	HRHS	-	-	150	41.2	37.3		
TS-2											
13141	R-9	7-361	103	MF	-	-	150	27.1	10.9		
42	R-33	"	411	"	-	-	150	39.95	28 0		
43	R-19	7-362	50	"	-	-	150	20.63	6.2		
44	R-18	"	205	"	-	-	150	34.30	18.2		
45	R-26	7-361	12	HRHS	-	-	150	20.73	3.5		
46	R-31	"	32	"	-	-	150	21.43	5.4		
47	R-24	7-362	2615	"	-	-	150	42.57	102.5		
48	R-4	"	18	"	-	-	150	19.45	4.0		
49	R-5	7-361	7495	Ekta	-	-	70				
50	R-6	"	53	ECP	0.5	85B	220				
51	R-12	7-362	40	"	0	85B	70				
52	R-17	"	84	"	0.5	85B	220				
53	R-8	7-361	5025	Tri X	-	-	150	41.16	78.5		
54	R-10	"	4075	"	-	-	150	41.45	72.8		
55	R-14	7-362	2990	"	-	-	150		-	*	
56	R-29	"	773	HRHS	-	-	150	42.93	38.7		

* Fired early and oscillated due to an unshielded transformer.

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Table 3.4 — (Continued)

					NAME				DATE		JOB NO.
					FILTERS						
FILM #	CAMERA #	STATION	TIME (μs)	EMULSION	ND	COLOR	EFF. APER.	Φ	DIAM (m)	REMARKS	
TS-3											
13241	R-9	7-361	100	MF	–	–	150	81.20	32.3		
42	R-33	"	403	"	–	–	150	82.25	57.2		
43	R-19	7-362	49	"	–	–	150			Blank	
44	R-18	"	4860	Tri X	–	–	150	76.40	143.8		
45	R-26	7-361	10	HRHS	–	–	150	66.14	10.4		
46	R-31	"	30	"	–	–	150	71.86	17.7		
47	R-24	7-362	7335	"	–	–	150	75.75	168.1		
48	R-4	"	17	"	–	–	150	72.62	14.2		
49	R-5	7-361	134	ECP	–	CC10M	70			Color	
50	R-6	"	31,675	Ekta	–	CC40M	70			Color	
51	R-12	7-362	215	ECP	–	86 + CC10M	70			Color	
52	R-17	"	80	"	–	86 + CC10M	70			Color	
53	R-8	7-361	20,130	Tri X	–	–	150	–	–	Fogged-warped camera back	
54	R-10	"	17,455	"	–	–	150	75.94	238.4		
55	R-14	7-362	10,756	"	–	–	150	75.54	195.4		
56	R-29	"	785	HRHS	–	–	150	81.19	73.7		
TS-4											
13341	R-9	7-361	100	MF	–	–	150	78.6	31.3		
42	R-33	"	403	"	–	–	150	72.4	50.3		
43	R-19	7-362	49	"	–	–	150	87.3	26.2		
44	R-18	"	4860	Tri X	–	–	150	69.4	130.7		
45	R-26	7-361	10	HRHS	–	–	150	126.2	20.0		
46	R-31	"	30	"	–	–	150	99.9	24.6		
47	R-24	7-362	7335	"	–	–	150	68.2	151.4		
48	R-4	"	17	"	–	–	150	115.8	22.7		
49	R-5	7-361	26,650	Ekta	–	CC40M	70			Color - light leakage thru single cell	
50	R-6	"	155	ECP	–	86 + CC10M	70			Color	
51	R-12	7-362	215	"	–	86 + CC10M	70			Color	
52	R-17	"	80	"	–	86 + CC10M	70			Color	
53	R-8	7-361	20,130	Tri X	–	–	150			NG	
54	R-10	"	17,455	"	–	–	150	68.6	215.5		
55	R-14	7-362	10,756	"	–	–	150	67.8	175.4		
56	R-29	"	785	HRHS	–	–	150	72.1	65.4		

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Table 3.4—(Continued)

					NAME				DATE		JOB NO.
					FILTER						
FILM #	CAMERA #	STATION	TIME (μs)	EMULSION	ND	COLOR	EFF APER.	Φ	DIAM (M)	REMARKS	
TS-5											
13441	R-9	1-355	95	MF	–	–	150	60.23	23.5		
42	R-33	"	403	"	–	–	150	66.21	46.0		
43	R-19	1-356	49	"	–	–	150	57.21	17.1		
44	R-18	"	210	"	–	–	150	67.15	36.0		
45	R-26	1-355	10	HRHS	–	–	150	60.86	9.6		
46	R-31	"	28	"	–	–	150	60.82	14.5		
47	R-24	1-356	7335	Tri X	–	–	150	64.13	142.3		
48	R-4	"	4400	"	–	–	150	64.85	117.3		
49	R-5	1-355	16,800	Ekta	-	CC40M	70			Color	
50	R-6	"	152	ECP	-	86 + CC10M	70			Color	
51	R-12	1-356	40	"	–	–	70			Color	
52	R-17	"	82	"	–	–	70			Color	
53	R-8	1-355	4940	Tri X	–	–	150	65.14	123.4		
54	R-10	"	8300	"	–	–	150	63.13	147.2		
55	R-14	1-356	10,900	"	–	–	150	62.65	162.9	weak exposure	
56	R-29	"	785	HRHS	–	–	150	66.57	60.4		
TS-6											
13641	R-9	4-356	95	MF	–	–	150	60.3	23.5		
42	R-33	"	403	"	–	–	150	63.0	43.8		
43	R-19	4-355	49	"	–	–	150	50.4	15.1		
44	R-18	"	210	"	–	–	150	64.8	34.7		
45	R-26	4-356	10	HRHS	–	–	150	47.7	7.5		
46	R-31	"	28	"	–	–	150	54.3	12.9		
47	R-24	4-355	7335	"	–	–	150	64.0	142		
48	R-4	"	4400	"	–	–	150	63.6	115		
49	TR-B	"	~0	BX	–	–	20				
50	TR-A	"	~0	Lin Pan	–	–	30				
53	R-8	4-356	4940	Tri X	–	–	150	63.3	120		
54	R-10	"	8300	"	–	–	150	62.2	145		
55	R-14	4-355	10,900	"	–	–	150	61.5	160	weak	
56	R-29	"	785	HRHS	–	–	150	67.3	61.1		
57	R-5	"	~0	Tri X	–	–	70			NG	Dark slides
58	R-6	"	~0	"	–	–	70			NG	not pulled
59	R-12	"	~0	"	–	–	70			NG	
60	R-17	"	~0	"	–	–	70			NG	

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Table 3.4—(Continued)

					NAME				DATE	JOB NO.
					Filter					
Film #	Camera #	Station	Time (μs)	Emulsion	ND	Color	Eff Aper.	Φ	Diam (m)	Remarks
TS-7										
13741	R-9	3-355	95	MF	–	–	150	66 4	25.9	
42	R-33	"	403	"	–	–	150	69 3	48.2	
43	R-19	3-356	49	"	–	–	150	50.4	15.1	
44	R-18	"	210	"	–	–	150	68 0	36.4	
45	R-26	3-355	10	HRHS	–	–	150			
46	R-31	"	28	"	–	–	150	61.9	14.7	
47	R-24	3-356	7335	TriX	–	–	150			NG- Transformer
48	R-4	"	4400	"	–	–	150	66.85	120.9	
49	TR-B	"	~0	BX	–	–	20			
50	TR-A	"	~0	Lin Pan	–	–	10			
53	R-8	3-355	13,650	TriX	–	–	150	66.19	[illegible]	
54	R-10	"	8300	"	–	–	150	65.96	153.8	
55	R-14	3-356	10,900	"	–	–	150	66 17	171.9	
56	R-29	"	785	HRHS	–	–	150	69.50	63.1	
57	R-5	7-248	~0	Tri X	–	–	70			
58	R-6	"	~0	"	–	–	70			
59	R-12	"	~0	"	–	–	70			
60	R-17	"	~0	"	–	–	70			
TS-8										
13841	R-9	2-356	95	MF	–	–	150	53.8	21.0	
42	R-33	"	403	"	–	–	150	66.1	46.0	
43	R-19	2-355	49	HRHS	–	–	150	46.4	13.9	
44	R-18	"	210	MF	–	–	150	61.4	32.9	
45	R-26	2-356	10	HRHS	–	–	150	22 9	3.6	
46	R-31	"	28	"	–	–	150	40 0	9.5	
47	R-24	2-355	7335	Tri X	–	–	150			NG – Transformer
48	R-4	"	4400	"	–	–	150	67.7	122.5	
49	TR-B	"	~0	BX	–	–	20			
50	TR-A	"	~0	Lin Pan	–	–	10			
53	R-8	2-356	13,650	TriX	–	–	150			NG- Transformer
54	R-10	"	8300	"	–	–	150	68.7	160.1	
55	R-14	2-355	10,900	"	–	–	150	66.6	173.1	
56	R-29	"	785	HRHS	–	–	150	69.5	63.1	
57	R-12	"	~0	Tri X	–	–	50			
58	R-6	"	~0	"	–	–	50			
59	R-17	"	5.5	HRHS	–	–	50			
60	R-5	"	3160	ECN	–	.	50			

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Delete

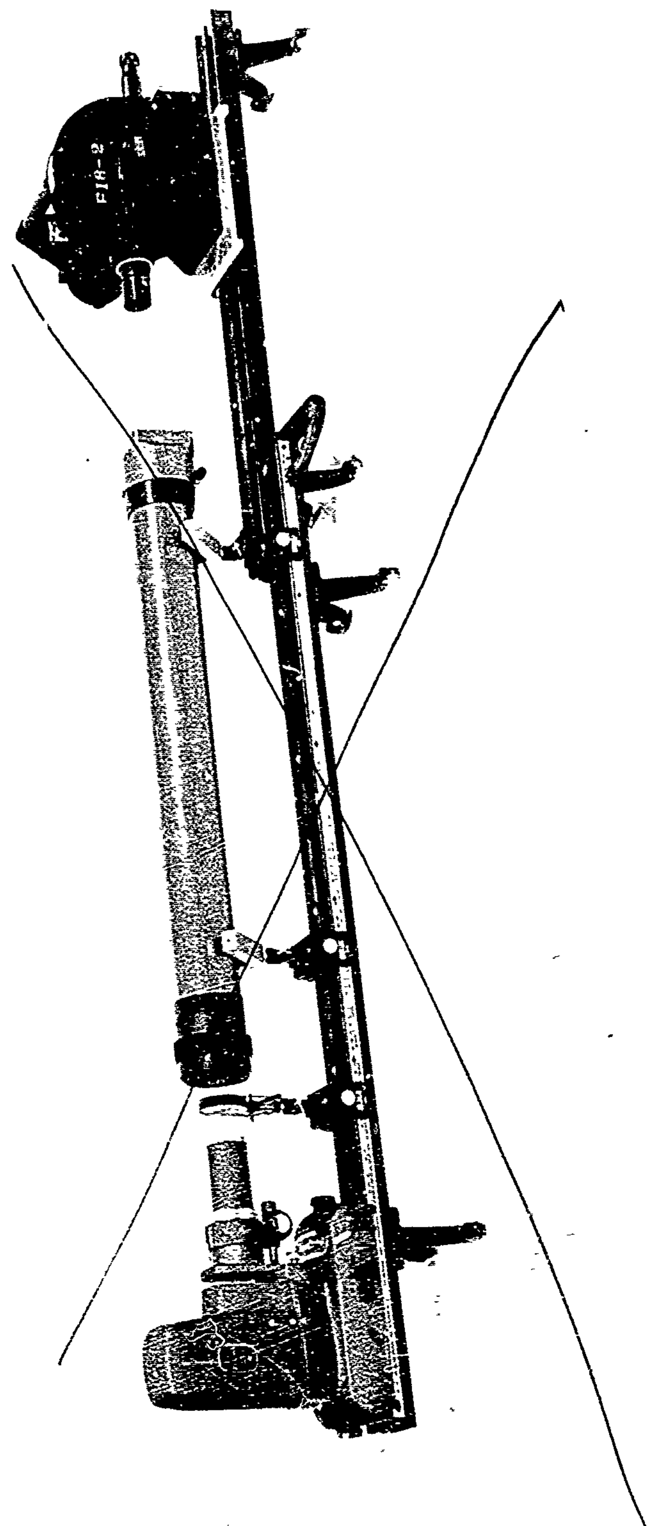

Fig. 3.21—Rapatronic collimator.

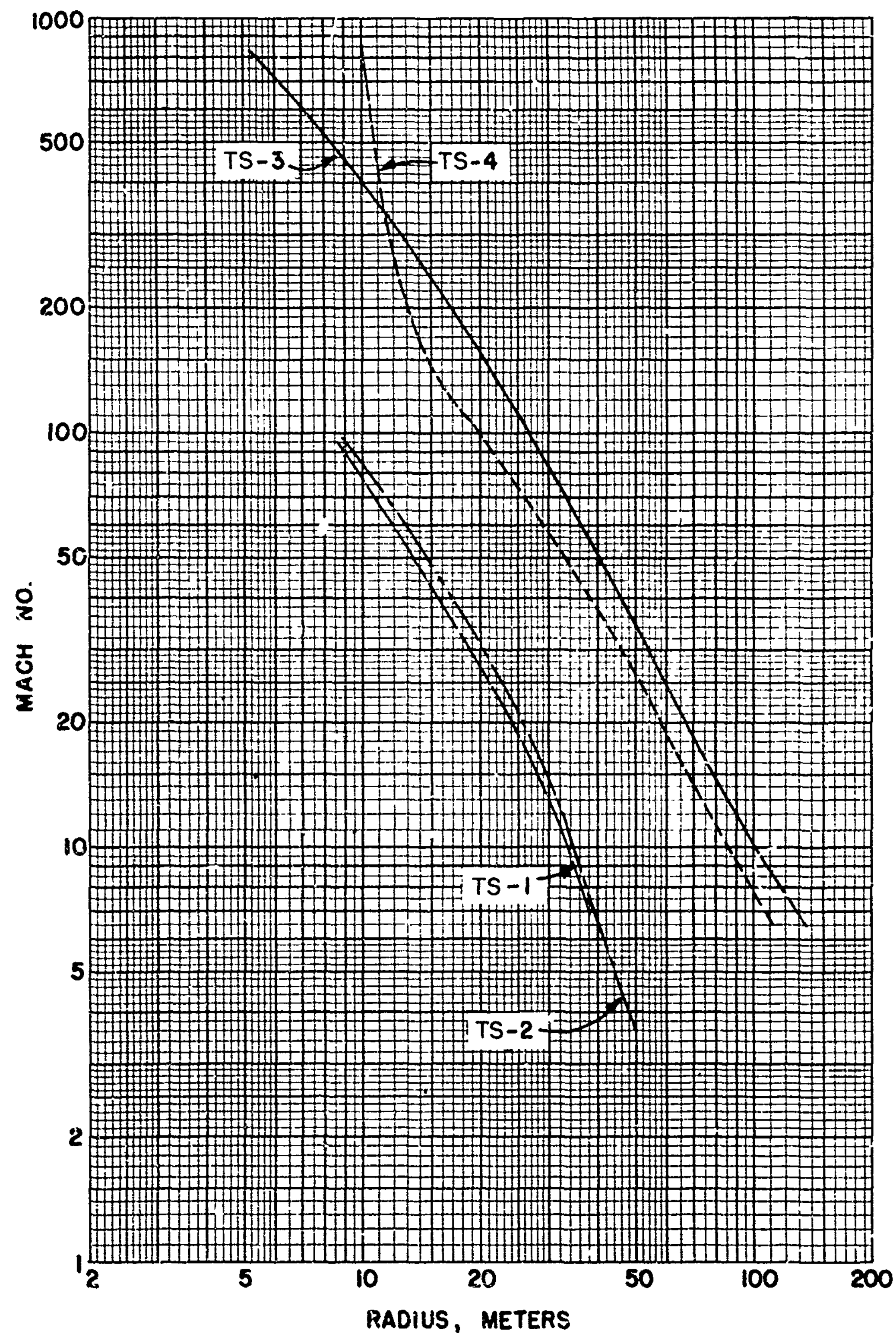

Fig. ~~3.22~~—Mach number vs radius, TS 1 to 4.
3.21

[redacted]

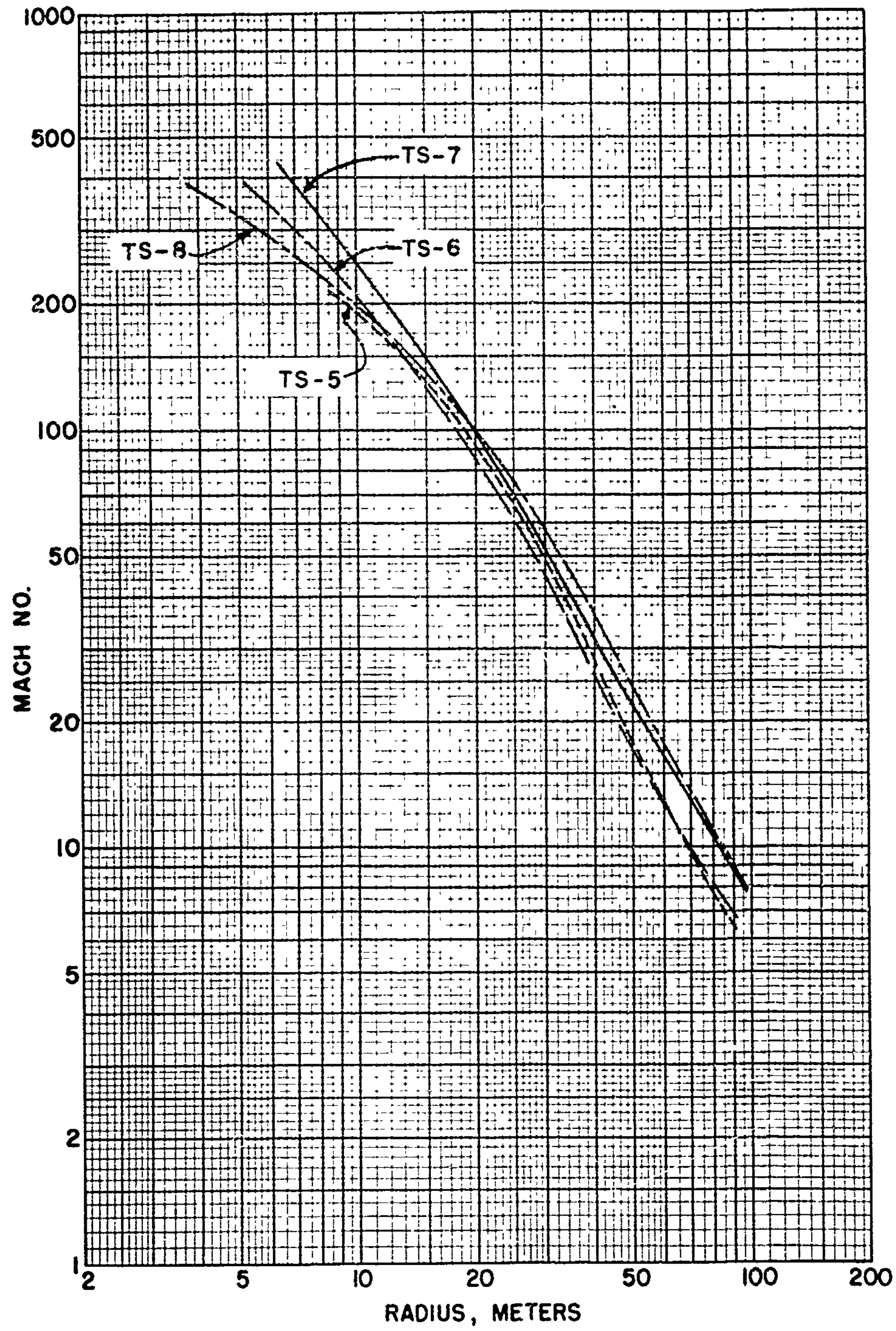

Fig. ~~3.23~~ Mach number vs radius, TS 5 to 8.
3.22

[redacted]

3.5.3 Time of Exposure

The exact time desired for the Rapatronic plate to be exposed can be set by means of a delay circuit connected to the camera. A Potter counter can then be used to calibrate this time interval between the zero-time signal and triggering of the camera shutter. A push button on the camera is connected to the input signal from the fiducial (which is actuated by bomb light). Thus a push on this button simulates zero time. The Potter counter indicates elapsed time from zero to the beginning of the exposure. The total delay is then the sum of the Potter counter reading and half the exposure duration of the film.

A pictorial report, Rapatronic Photography on Operation Tumber-Snapper, EG&G-OUT 1034, 29 December 1952, shows the views of each fireball from the two stations in time sequence.

3.6 MACH NUMBER AS A FUNCTION OF TIME

It is possible to calculate velocity of the shock front from the ϕ and diameter vs time relations. From the equation

$$D = Kt^n$$

let

$$U = \frac{1}{2}\frac{dD}{dt} = \frac{1}{2}\frac{nD}{t}$$

where U = velocity of shock front
D = fireball diameter
t = time
n = time exponent

The Mach number is the ratio of the velocity of the shock front, U (which is coincident with the edge of the fireball before breakaway), and the velocity of sound, C_0, which varies according to the formula

$$C_0 = 331.5 + 0.607T$$

where C_0 is velocity in meters per second and T is temperature in °C. Values of C_0 are tabulated for each shot in Appendix E. The Mach number is plotted as a function of fireball radius in Figs. ~~3.22~~ and ~~3.23~~.
3.21 3.22

REFERENCES

1. Richard A. Houghten, Analysis of Fireball Growth at Ranger, Ranger Report, Vol. 3, WT-203.
2. Ball-of-fire Observations, Greenhouse Report, Annex 1.4, WT-101.
3. Technical Photography, Buster-Jangle Project 10.3 Report, WT-417, December 1952.

[redacted]

CHAPTER 4

TELETRONIC CAMERA

In order to study the appearance of a detonation at approximately zero time, it is necessary to obtain a small field of view from a considerable distance and to have an exposure duration of the order of 1 μsec. This was attained by a teletronic camera on Greenhouse.[1] The same camera with minor adjustments was used on Buster-Jangle. These cameras are similar in operation to the Rapatronic.

Two such cameras were employed on the last three shots of Tumbler-Snapper. One utilized a Cassegrainian telescope and the other a Newtonian telescope to produce a good size image of only the region near the cab.

Preshot photos of the zero tower for TS-8 taken with the Newtonian type and with the Cassegrainian type telescopes are shown in Figs. 4.1 and 4.2, respectively. Figures 4.3 and 4.4 are photographs taken of the TS-8 zero tower at approximately zero time with the Newtonian type and the Cassegrainian type, respectively.

REFERENCE

1. Ball-of-fire Observations, Appendix C, Greenhouse Report, Annex 1.4, WT-101.

Fig. 4.1—Preshot photograph of TS-8 tower, Newtonian type camera.

[redacted]

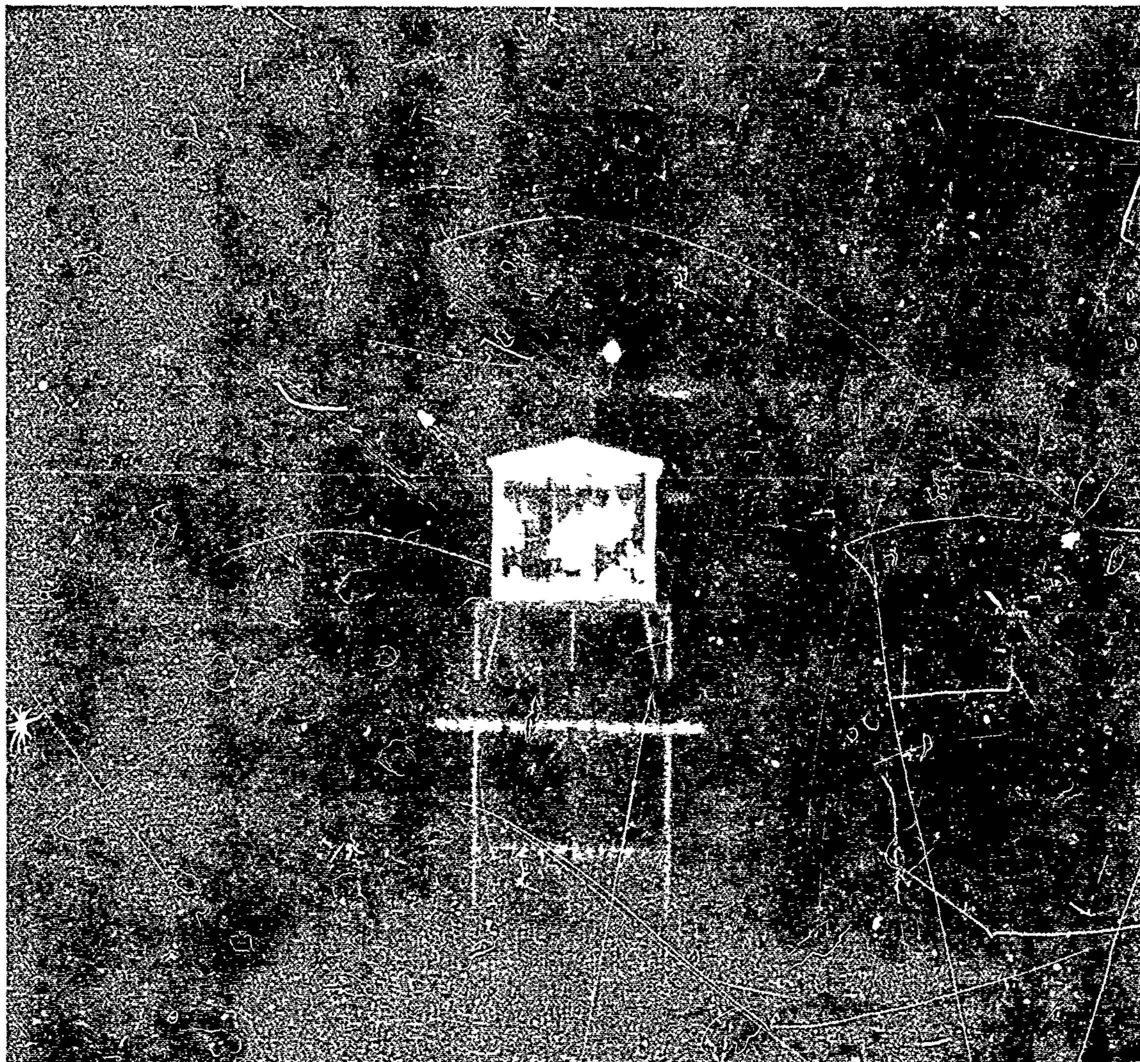

Fig. 4.2—Preshot photograph of TS-8 tower, Cassegrainian type camera.

[redacted]

Fig. 4.3—Approximately zero time photograph of TS-8 tower, Newtonian type camera.

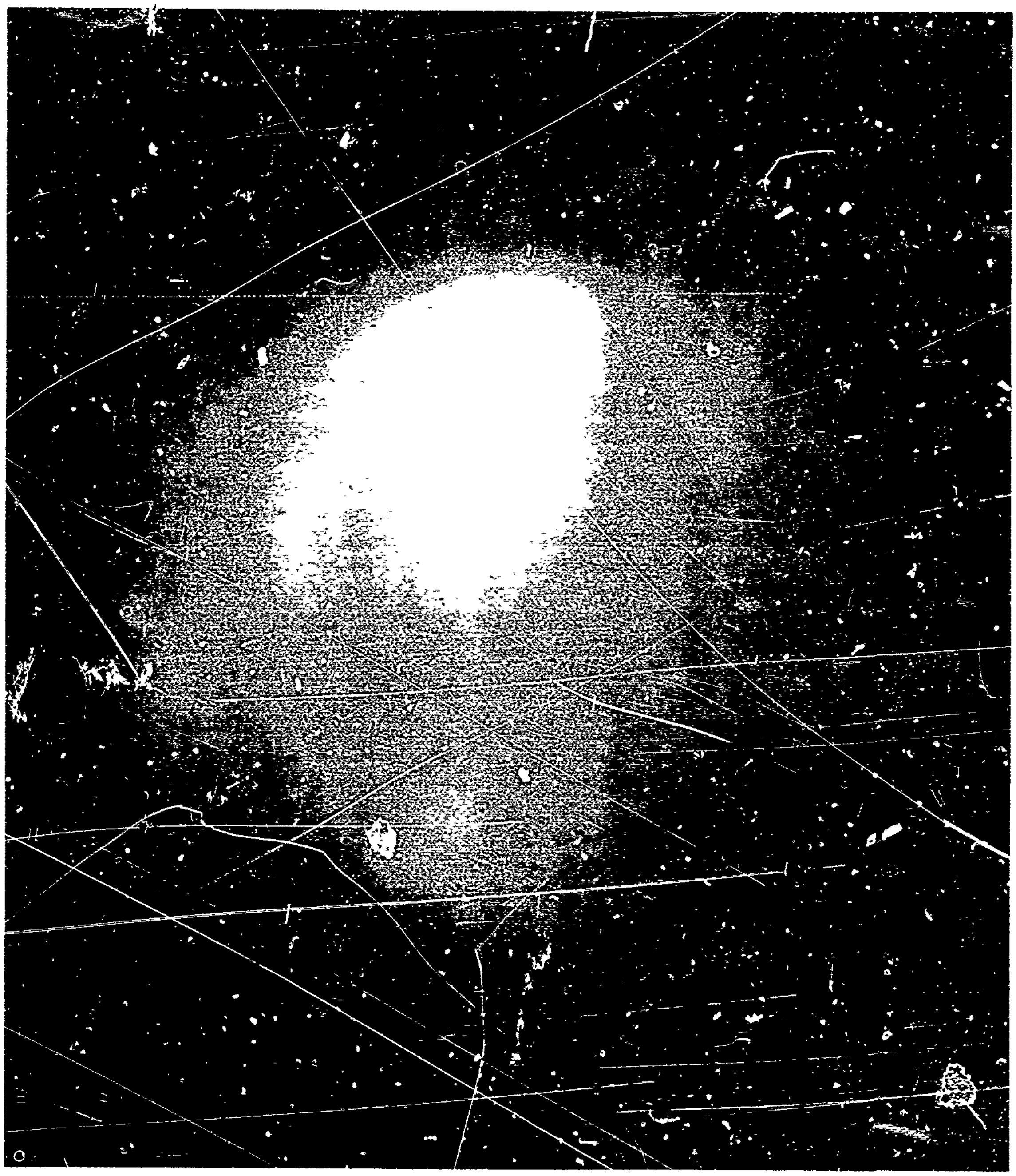

Fig. 4.4—Approximately zero time photograph of TS-8 tower, Cassegrainian type camera.

[redacted]

CHAPTER 5

POSITION OF BURST

Position-of-burst determination was required for the four airdrops (TS 1 to 4) of the Tumbler-Snapper series. Two Wild phototheodolite cameras and two modified K-17 cameras were used for each shot, one camera of each type being set up at two of the standard photostations on a concrete platform adjacent to the truck or trailer.

Shadow images of battery-operated fiducial markers were placed on the film in an exposure made the day before the shot, and the fireball image was superimposed in a second exposure. A typical example taken with a Wild phototheodolite is shown in Fig. 5.1. Each camera was triggered by the closing of a relay by means of a signal from a photocell (Blue Box) at zero time. The phototheodolite exposure time was set at $\frac{1}{200}$ sec and the K-17 at $\frac{1}{150}$ sec. Thus exposures were made during the time when the edges of the fireball were still sharp and clear, and the exact center of the fireball, which was assumed to be the initial burst position, could be accurately determined. Coordinates of the burst were found by triangulation from the two photostations.

Two Mitchell camera records intended primarily for data on rockets were used to determine burst position for TS-1, because the theodolite solenoid pulsers failed to operate. Silvered glass globes at known distances in [illegible] field of view of the cameras were used as reference markers in this case.

All survey cameras operated satisfactorily for the other three airdrops. A summary of burst positions and aiming errors is presented in Table 5.1.

Inasmuch as TS 5 to 8 were tower shots, it was not necessary to use the theodolite cameras for determination of burst.

Table 5.1—POSITION-OF-BURST DATA SUMMARY

		Coord. of detonation, ft			Aiming error, ft			
Shot	Area	N	E	Z (burst ht.)	ΔN	ΔE	Circular error	ΔZ
TS-1	F	746372	714067	793	122	67	140 ± 20	−7 ± 10
TS-2	7	850281	688769	1109	−143	84	165 ± 20	+9 ± 10
TS-3	7	850344	688561	3447	−80	−124	148 ± 20	−3 ± 10
TS-4	7	850284	688532	1040	−140	−153	205 ± 20	−10 ± 10

[redacted]

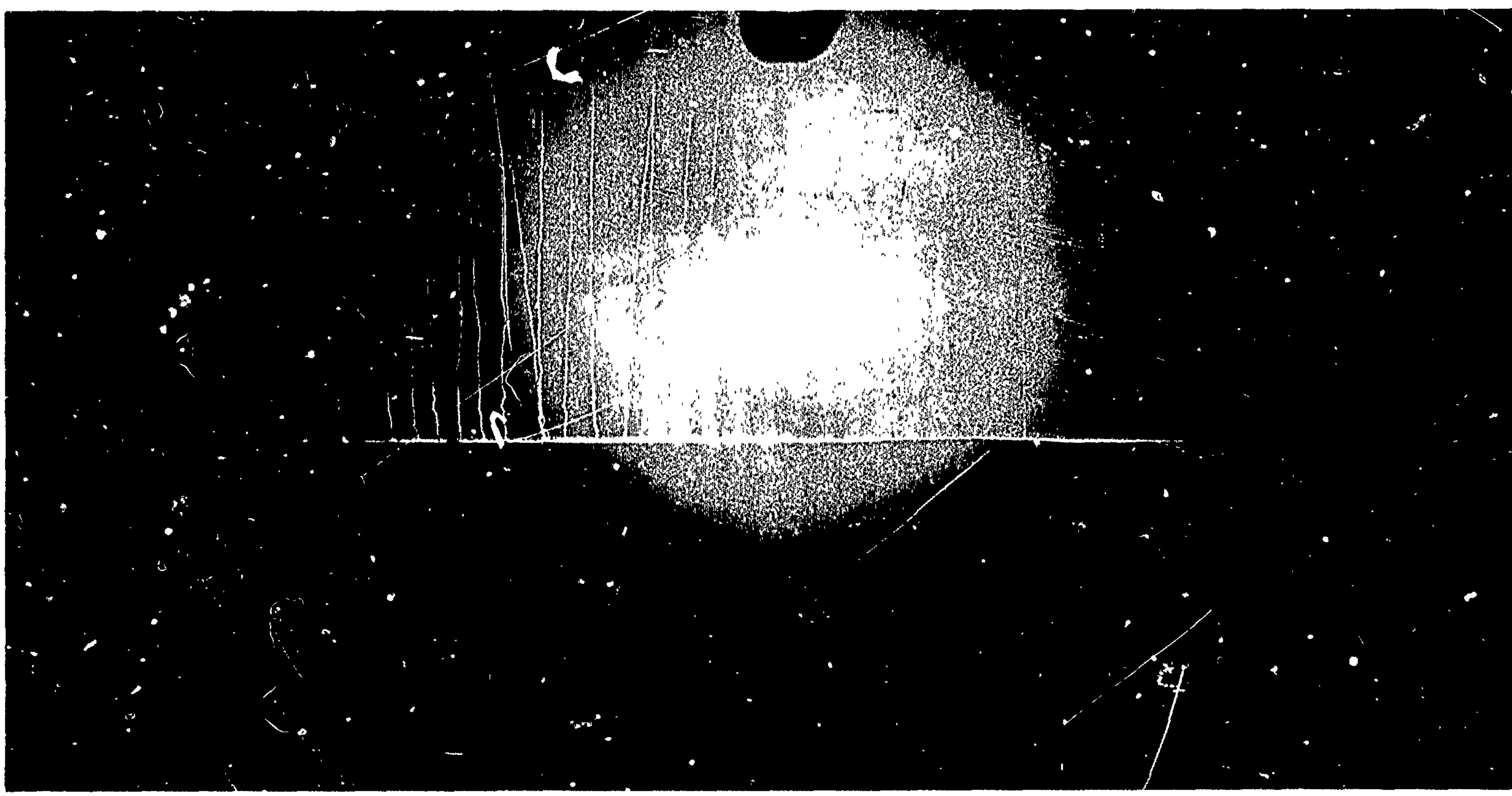

Fig. 5.1—Typical photograph of burst taken with the Wild phototheodolite.

[redacted]

CHAPTER 6

BLAST STUDIES

EG&G was asked to supply certain information which would aid in the various studies of blast. On the airdrops this was accomplished by photography of mortar puffs, Jato plumes, and rocket trails, and on the tower shots by gun puffs and shock studies.

In most instances the services of EG&G were those of obtaining the photographic record and developing and processing of films. These films, with the necessary data for interpretation, were transferred to the various groups concerned for their own analysis. The only exception to this procedure was the measurement of motion of the mortar puffs by EG&G personnel. These measurements were made at the request of J-Division, Los Alamos Scientific Laboratory (LASL), and were turned over to them without further analysis. This report will concern itself with the plan by which EG&G obtained the desired pictures.

To show individually all of the camera-station layouts for each study for all shots would prove too lengthy. Therefore the separate layouts for each study, such as rockets, mortars, etc., have been broken down for TS-1 only and are shown in Appendix C. Layouts for TS 2 to 4 have been combined in three master maps and also appear in Appendix C.

6.1 AIR-MASS MOTION

In order to study the effect of blast on free air, a new technique was devised. Particles of smoke from inverted Jato columns and from mortar-shell smoke puffs were considered to behave in the same manner as particles of air, and the actual motion of a smoke particle was used for measurement.

The "Jatos" were smoke generators located along a line 500 ft from the blast line and parallel to it. These were timed so as to set up a column of smoke before arrival of the shock wave. The mortar puffs were essentially a type of commercial fireworks, sometimes known as aerial salutes, the only change being that the yellowish smoke burst was replaced by a white smoke for better visibility. The inverted Jatos, reaching a height of about 200 ft, showed the trajectory of the triple point, and illustrated, in a general way, the shape of the shock front as it passed by and deflected them. By measuring the motion of the mortar puffs, 200 to 300 ft above ground, the velocity of the shock wave and, hence, overpressure can be calculated.

A series of 10 mortar-Jato stations was set up for each the four airdrops. Six Eastman cameras and three Mitchells were located at two of the normal photostations as indicated in Fig. 6.1. Cameras were aimed so that each camera would view one or two of the Jato stations, several of the stations being viewed by two cameras with overlapping fields of view.

Preliminary measurements of mortar-puff motion were made from the Eastman films, but EG&G made no attempt to analyze the results in Boston other than to plot displacement vs time in two dimensions only. These measurements were sent to J-Division, LASL, who were to conduct any further analysis.

[redacted]

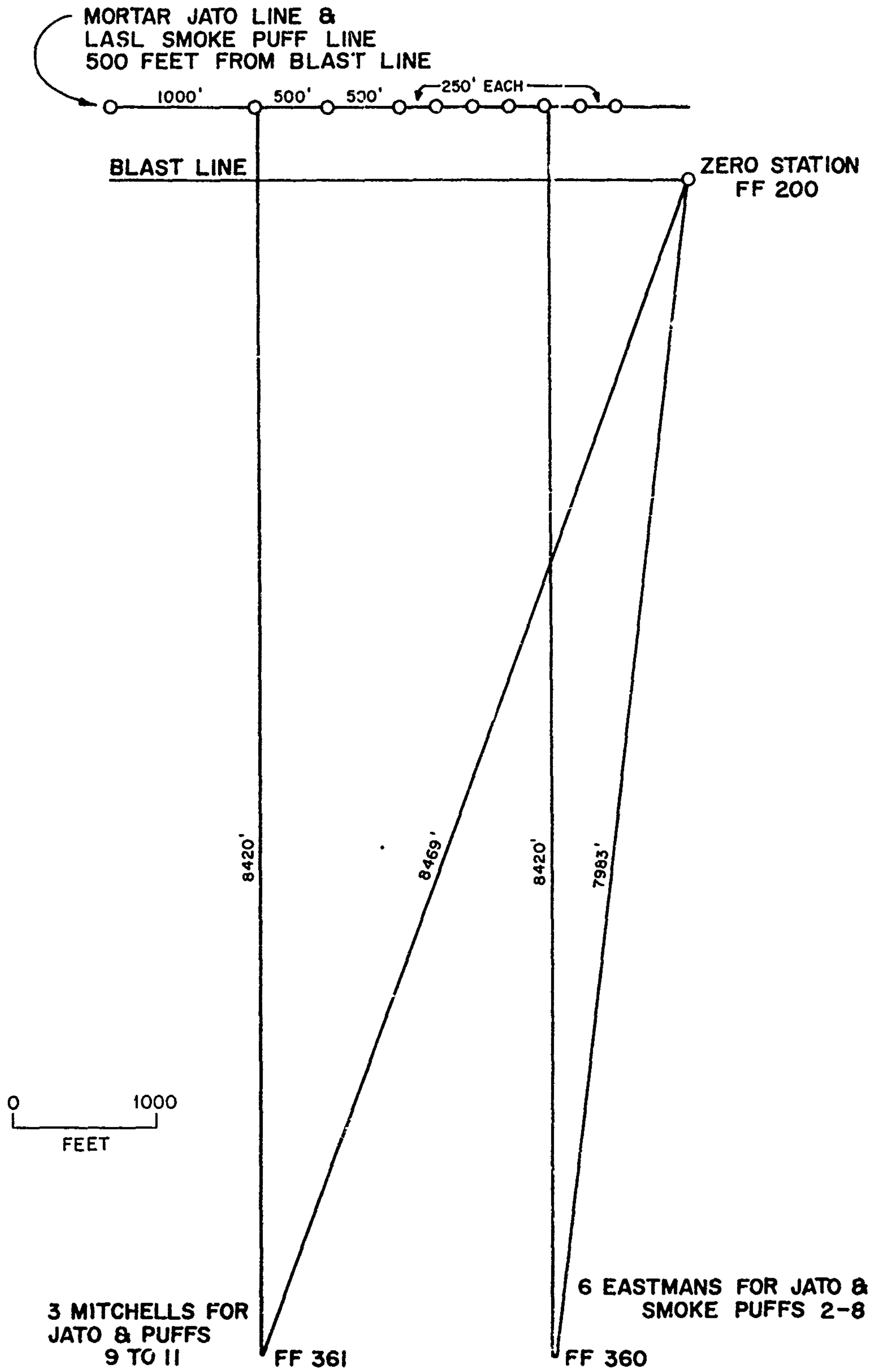

Fig. 6.1—Camera layout for TS-1 blast.

[redacted]

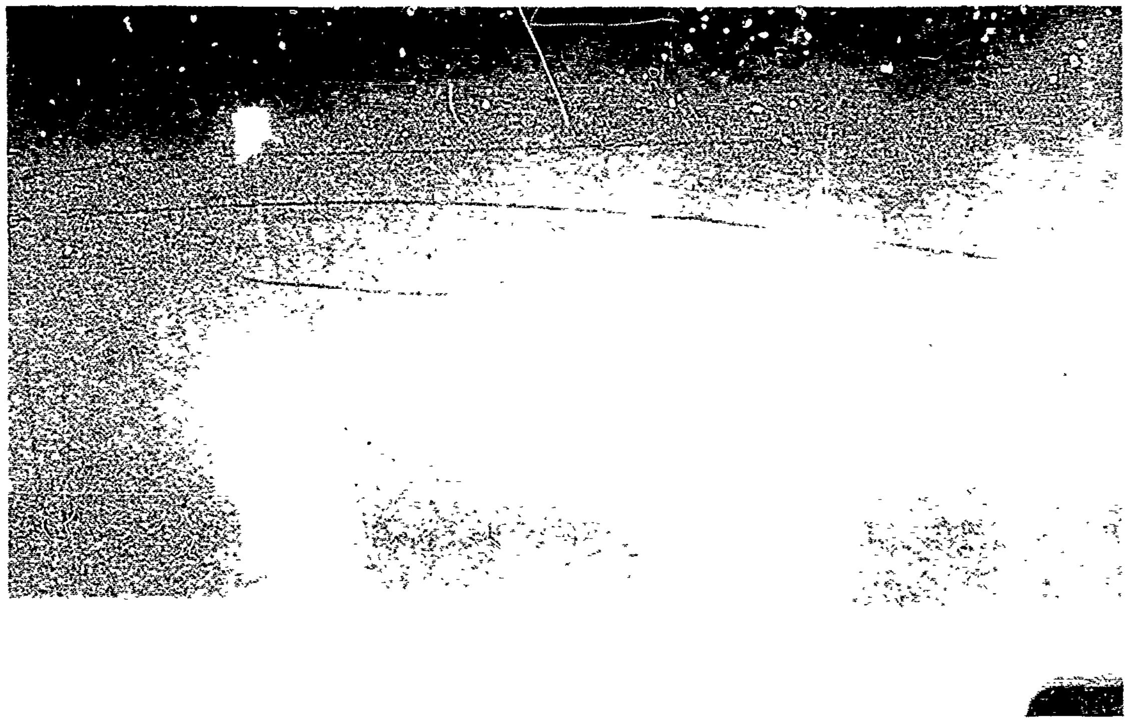

Fig. 6.2—Eastman photograph of shock wave crossing field of view of camera. Note position of triple point.

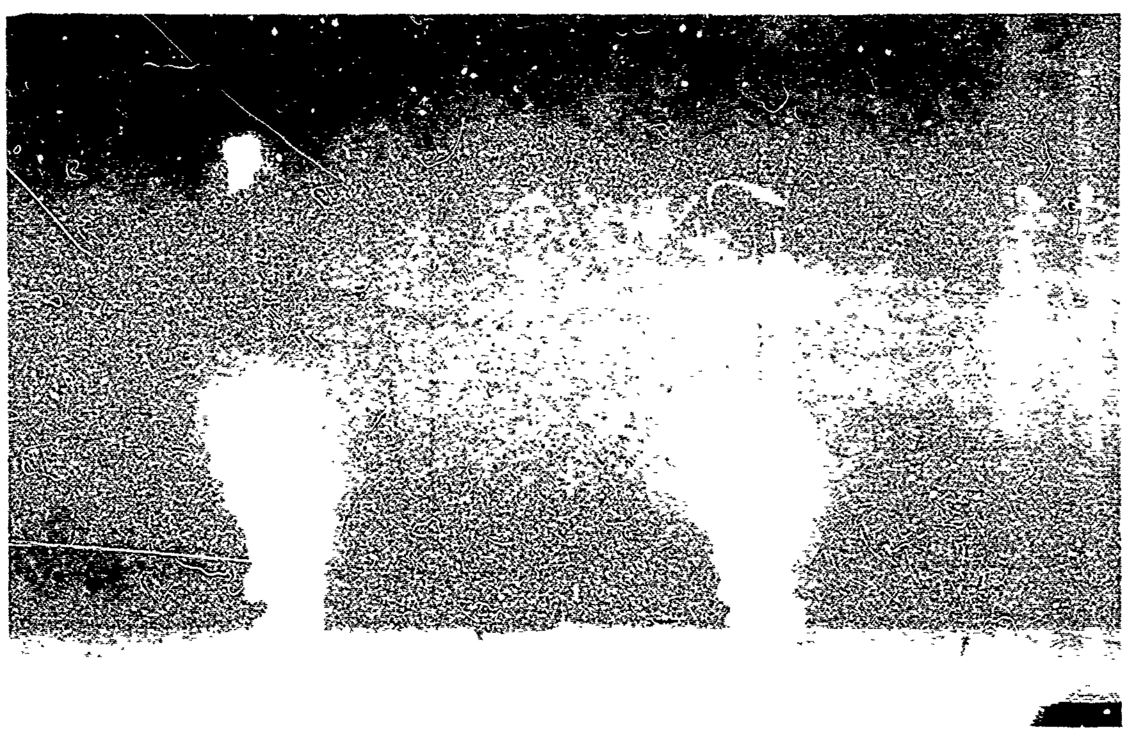

Fig. 6.3—Eastman photograph of shock wave crossing field of view of camera. 40 frames after Fig. 6.2. Right plume has shifted, and triple point has moved to a position between the two plumes.

[redacted]

Rocket trails were also used on the airdrop for the determination of particle velocity and as backup for the mortar-Jato stations. Here again a particle of smoke was assumed to behave identically with a particle of air. This was the first time rocket trails had been used for this purpose.

For two tower shots, TS 5 and 8, gun puffs of black smoke were photographed by three Mitchell cameras to record mass motion of the air. These records were not as successful as the white-smoke photographs, since all films were underexposed and showed weak positive motion only. Gun puffs were not used on TS 6 and 7.

Since no rocket trails were employed on the four tower shots, an attempt was made to photograph the visible shock wave leaving the fireball and also the formation of the stem and dust skirt. For this purpose, three Eastman cameras using microfile film were employed. Several of the films showed the shock wave clearly as it passed across the field of view of the camera. Figures 6.2 and 6.3 are excellent examples of the results of this technique. In these photographs, taken from a 16-mm Eastman record on the first shot, both the incident and reflected shock waves are clearly visible, first approaching one Jato and then, 40 frames later, between the two Jato plumes. The motion of the Jato which has been passed by the shock wave is evident from a comparison of the two pictures.

6.2 SHOCK-WAVE PROPAGATION

In order to study the velocity of the shock front on the four airdrops of Tumbler-Snapper, rocket trails were located perpendicular to the line of sight of the cameras, and the shock wave was photographed as it passed in front of these trails. The progress of the shock wave was then followed by observing the "hooks" in the rocket trails at the shock front. These hooks are due to the change in the index of refraction of the air at the shock front. This same system had previously been employed on Greenhouse.

The rockets were fired at 85° angles radially away from their respective photostations in order that the trails would appear as straight lines on the film.

High-speed Mitchell cameras, running at 100 frames/sec, obtained the film records which were then sent to the Naval Ordnance Laboratory for analysis.

The physical layout of the cameras with respect to the blast line and rocket trails is shown in Fig. 6.1.

[redacted]

CHAPTER 7

ADDITIONAL PHOTOGRAPHY

7.1 THERMAL EFFECTS

This program was initiated by AFSWP to provide supplementary data to the general blast-measurement program. The study was to indicate the presence of "thermal dust" and "temperature gradients" near the ground. These dust, preshock-turbulence, light-absorption, and mirage effects were recorded with A-5 cameras running at approximately 35 frames/sec, located 200 ft off the blast line (see Fig. 7.1). These stations consisted of concrete cubicles 18 in. from the ground, into each of which a rack containing two cameras was inserted from the top. The access hole was then sealed with a lead block, and the pictures were taken through a glass window located on one side of the station.

Smoke generators were started prior to zero time, and the smoke pattern was photographed to show the behavior of prezero laminar and turbulent air flow.

Spotlights hung in the field of view at $1\frac{1}{2}$, 3, 6, and 12 ft from the ground were used to determine the amount of light absorption and air turbulence.

Temperature gradients were observed by noting air turbulence and the total reflection or refraction such as that associated with mirage conditions.

These pictures also provided a study of the thermal dust created before shock arrival from the intense heat which literally causes the ground to explode. All such films were turned over to AFSWP for analysis.

7.2 CLOUD STUDIES

During Tumbler-Snapper the cloud formations associated with the various shots were photographed from various angles with cameras running at a variety of speeds for the purpose of studying cloud drift and rate of rise.

The cloud-rise program was designed to record the dimensions and altitudes attained by the cloud and stem following breakaway of the shock wave. High-speed Mitchell and Bell & Howell cameras and low-speed Eastman cameras were operated from two photostations for the three airdrops in Yucca Flat and from only one station for TS-1 and the four tower shots.

The cloud-tracking program utilized one station only. It was located at Mt. Charleston. This station was equipped with low-speed Mitchell and K-17 cameras. This study was undertaken for the three Yucca Basin airdrops only.

Results of analysis of these films by EG&G are listed in a memorandum issued as EG&G-OUT 996. A summation of these data is presented in Table 7.1. Cloud height and size are shown at 5, 15, and 30 sec after detonation for the first four shots. Owing to the fact that the tower shots were all predawn, no data could be obtained later than 5 sec on any of these. No films could be measured on TS-6.

[redacted]

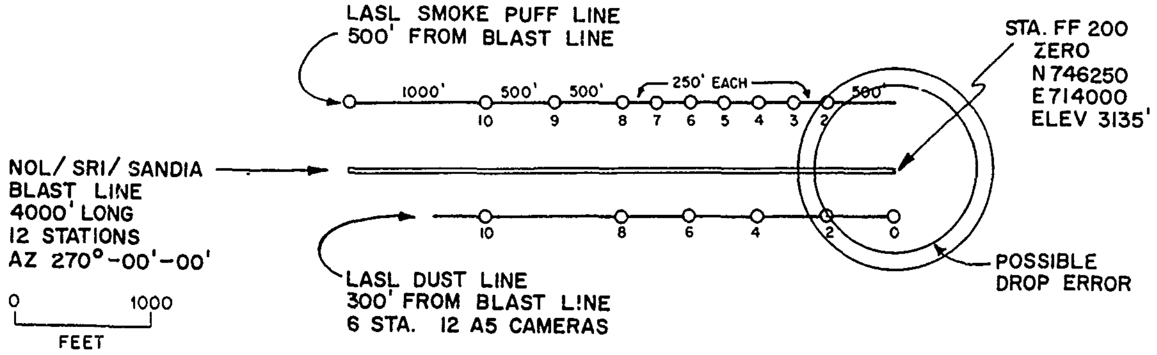

Fig. 7.1—Blast and dust station arrangement, TS-1.

7.3 LUMINOUS EMITTANCE AS A FUNCTION OF TIME

General Radio slit cameras using continuously moving 35-mm film were again employed during Tumbler-Snapper in an attempt to determine the range of bomb-light levels and the curve of this light as a function of time. The basic method of obtaining these records has been described previously.[1] To ensure at least one usable record for each degree of light intensity, a series of neutral-density filters in steps ranging from 0.5 to 3.0 was placed across the slit. Band-pass filters covering the blue, yellow, and infrared band were also used to permit determination of the spectral quality of the light emitted by the bomb.

An attempt was made to analyze these slit records using the Jarrell-Ash microphotometer pictured in Fig. 7.2. This instrument consists essentially of a moving film transport which passes across a slit. Light is projected through the slit onto a photocell which is, in turn, connected to a chart recorder. The trace thus obtained on chart paper shows variations in density along the strip of film. The film spools and chart spools may be adjusted so as to give a time resolution of about 10 μsec.

The evaluation of the data thus obtained has run into several trouble areas which will require more extensive research, mainly in the study of emulsion sensitivities. It is not felt advisable to present the data obtained to date from the General Radio slit records until a more thorough study has been undertaken. It may be reported, however, that slit-record data coupled with density readings taken from Rapatronic plates have aided in obtaining the general shape of the light curve as a function of time. The data have also been helpful in predicting camera exposures required for operations following the Tumbler-Snapper series.

7.4 DISC CAMERA

Instrumentation suitable for yield determination from aircraft was again required on this operation. Accordingly, the Special Weapons Command installed an EG&G Disc camera in B-50 #7169 for use on TS 2 to 4. This aircraft was used as the drop aircraft on TS 2 and 3 and accompanied the drop aircraft on TS-4.

The principle and the operation of the Disc camera have been discussed generally in a previous report[1] and will be discussed in more detail in a forthcoming report.[2]

The Disc camera operated satisfactorily in all cases, giving measurable traces from all three streaks. Tables 7.2 to 7.4 summarize data obtained from these records. Separate curves of diameter vs time for each trace are shown in Figs. 7.3 to 7.5, indicating the close agreement of all three traces. Plots of ϕ vs time, comparable to those for the Eastman records previously discussed, are presented in Figs. 7.6 to 7.8. It may be observed that very close agreement exists between Eastman and Disc camera records in all cases.

REFERENCES

1. Technical Photography, Buster-Jangle Project 10.3 Report, WT-417, December 1952.
2. Airdrop Instrumentation, Disc Camera, Greenhouse Report, Annex 1.9, Part III.

[redacted]

Table 7.1 — SUMMARY OF CLOUD-TRACKING DATA

				NAME Tumbler-Snapper			DATE		JOB NO.
Shot	Burst Height (meters)	Time (sec)		Height Above Burst (meters)	Horiz Diam (meters)	Vert. Thick. (meters)	Stem Width (meters)		
1	242	5		155	300	195	70		
		15		415	430	169	40		
		30		738	640	205	115		
2	338	5		139	270	237	—		
		15		393	400	385	—		
		30		799	570	295	83		
3	1051	5		265	720	270	—		
		15		692	990	410	—		
		30		1390	1255	250	—		
4	317	5		276	540	345	190		
		15		733	818	284	135		
		30		1390	1090	280	200		
5	96	5		26	505	230	185		
		15		—	—	—	—		
		30		—	—	—	—		
6	96	5		No data available					
		15		" " "					
		30		" " "					
7	96	5		131	485	250	240		
		15		—	—	—	—		
		30		—	—	—	—		
8	96	5		6	470	375	—		
		15		—	—	—	—		
		30		—	—	—	—		

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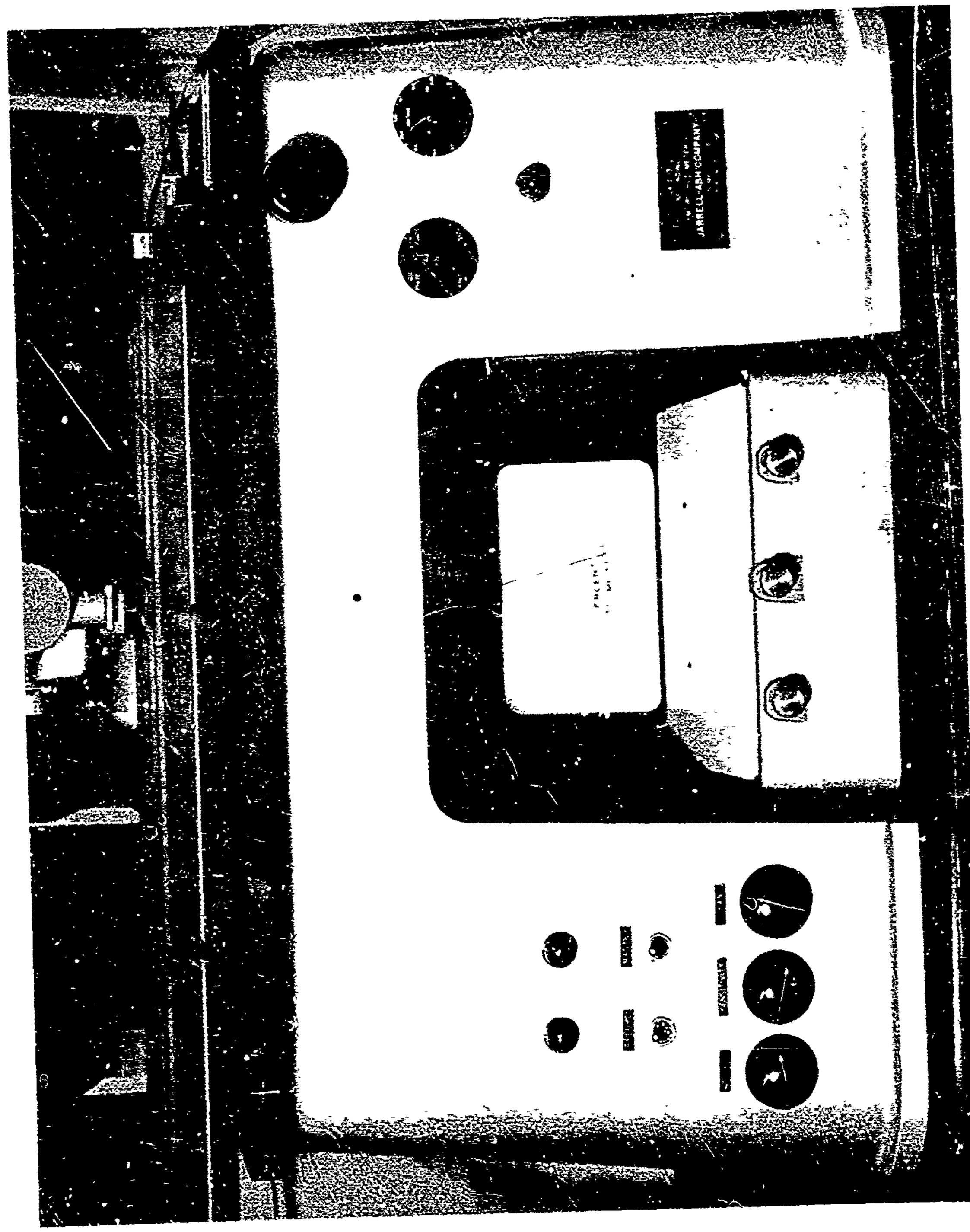

Fig. 7.2—Jarrell-Ash microphotometer.

Table 7.2—DISC CAMERA SUMMARY, TS-2

					NAME			DATE		JOB NO.
Time (ms)	$t^{-2/5}$		Diameter (meters)					$\phi (m/ms^{2/5})$		
			Outer Trace	Middle Trace	Inner Trace		Outer Trace	Middle Trace	Inner Trace	
1.01	.9960		48.60	47.61	48.38		48.40	47.42	48.19	
1.52	.8458		55.62	54.19	54.41		47.04	45.83	46.02	
2.03	.7533		60.99	59.24	59.57		45.94	44.63	44.87	
2.53	.6898		64.39	62.75	63.74		44.42	43.28	43.97	
3.04	.6410		68.56	67.25	67.25		43.95	43.11	43.11	
4.05	.5715		74.82	73.39	73.28		42.76	41.94	41.88	
5.06	.5228		80.52	78.44	78.22		42.10	41.01	40.89	
6.08	.4858		84.58	83.04	83.37		41.10	40.34	40.50	
7.09	.4568		89.08	86.66	87.32		40.69	39.59	39.88	
7.60	.4443		90.94	88.53	89.30		40.40	39.33	39.68	
8.10	.4331		92.17	89.73	90.50		40.05	38.86	39.20	
8.61	.4227		93.90	91.38	92.15		39.69	38.63	38.95	
9.12	.4130		95.33	92.70	94.02		39.37	38.29	38.83	
9.62	.4043		96.76	94.56	94.67		39.12	38.23	38.28	
10.13	.3960		97.96	95.33	95.55		38.79	37.75	37.84	
10.63	.3885		99.28	96.65			38.57	37.55		
11.14	.3813		101.3	98.18	98.07		38.63	37.44	37.94	
11.65	.3745		101.9	99.39			38.16	37.22		
12.15	.3683				99.72				36.73	
12.66	.3622		104.1	101.6			37.71	36.80		
13.17	.3566				101.6				36.23	
13.67	.3513		106.2	103.9			37.31	36.50		
14.69	.3413		110.4	106.0			37.68	36.18		
15.19	.3368				105.4				35.50	
15.70	.3324		111.3	107.9			37.00	35.87		
16.71	.3242			109.5				35.50		
17.22	.3203				109.4				35.04	
18.23	.3131		115.4				36.13			
18.74	.3096			112.8				34.92		
19.24	.3064				112.0				34.32	
19.75	.3032		117.9				35.75			
21.27	.2944			114.2	114.8			33.62	33.80	
21.78	.2916		121.8				35.55			
23.29	.2839				117.2				33.27	
24.81	.2768		125.6				34.77			
25.32	.2746				118.9				32.65	
26.33	.2703		126.7				34.25			
27.35	.2662				121.1				32.24	

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Table 7.3—DISC CAMERA SUMMARY, TS-3

					NAME			DATE		JOB NO.
Time (ms)	$t^{-2/5}$		Diameter (meters)				ϕ (m/ms$^{2/5}$)			
			Outer Trace	Middle Trace	Inner Trace		Outer Trace	Middle Trace	Inner Trace	
1.02	.9921		89.60	87.88	89.60		88.89	87.19	88.89	
1.53	.8436		100.7	99.90	99.90		84.95	84.27	84.27	
2.04	.7519		102.6	109.1	110.8		77.14	82.03	83.31	
2.56	.6866		109.4	116.8	119.4		75.11	80.19	81.98	
3.07	.6385		123.9	123.6	126.9		79.11	78.92	81.03	
3.58	.6004		130.0				78.05			
4.09	.5693		135.5	136.0	139.9		77.14	77.42	79.65	
4.60	.5431		140.8				76.47			
5.11	.5207			146.7	149.7			76.39	77.95	
5.62	.5013		150.0				75.20			
6.13	.4842			156.6	160.6			75.83	77.76	
6.64	.4690		158.9				74.52			
7.15	.4553		163.6	166.2	169.8		74.49	75.67	77.31	
7.67	.4427		168.0	171.7			74.37	76.01		
8.18	.4314		173.0	175.1	177.8		74.63	75.54	76.70	
8.69	.4211			179.4	183.9			75.55	77.44	
9.20	.4116			183.1	186.5			75.36	76.76	
9.71	.4028			186.1	190.3			74.96	76.65	
10.22	.3946			190.4	195.1			75.13	76.99	
10.73	.3870			193.3	197.6			74.81	76.47	
11.24	.3799			192.8	201.8			73.21	76.66	
11.75	.3732				204.5				76.32	
12.26	.3670				208.5				76.52	
12.78	.3609				211.8				76.44	
13.29	.3553				213.4				75.82	
13.80	.3500									

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Table 7.4—DISC CAMERA SUMMARY, TS-4

			NAME				DATE			JOB NO.
Time (ms)	$t^{-2/5}$		Diameter (meters)				ϕ ($m/ms^{2/5}$)			
			Outer Trace	Middle Trace	Inner Trace		Outer Trace	Middle Trace	Inner Trace	
1.01	.9960		72.5	73.3	74.9		72.2	73.0	74.6	
1.52	.8458		83.8	84.0	85.6		70.9	71.0	72.4	
2.02	.7548		92.7	92.8	94.6		70.0	70.0	71.4	
2.53	.6898		99.6	100.9	102.4		68.7	69.6	70.6	
3.04	.6410		107.0				68.6			
3.54	.6031			113.4	114.9			68.4	69.3	
4.05	.5715		118.6				67.8			
4.55	.5455			123.8	125.4			67.5	68.4	
5.06	.5228		127.9				66.9			
5.57	.5031			131.7	134.7			66.8	67.8	
6.07	.4861		136.3				66.3			
6.58	.4707			140.3	142.6			66.0	67.1	
7.09	.4568		143.4	144.2			65.5	65.9		
7.59	.4445			148.6	150.6			66.1	66.9	
8.10	.4331		152.9	150.7			66.2	65.3		
8.60	.4229				157.8				66.7	
9.11	.4132		159.9				66.1			

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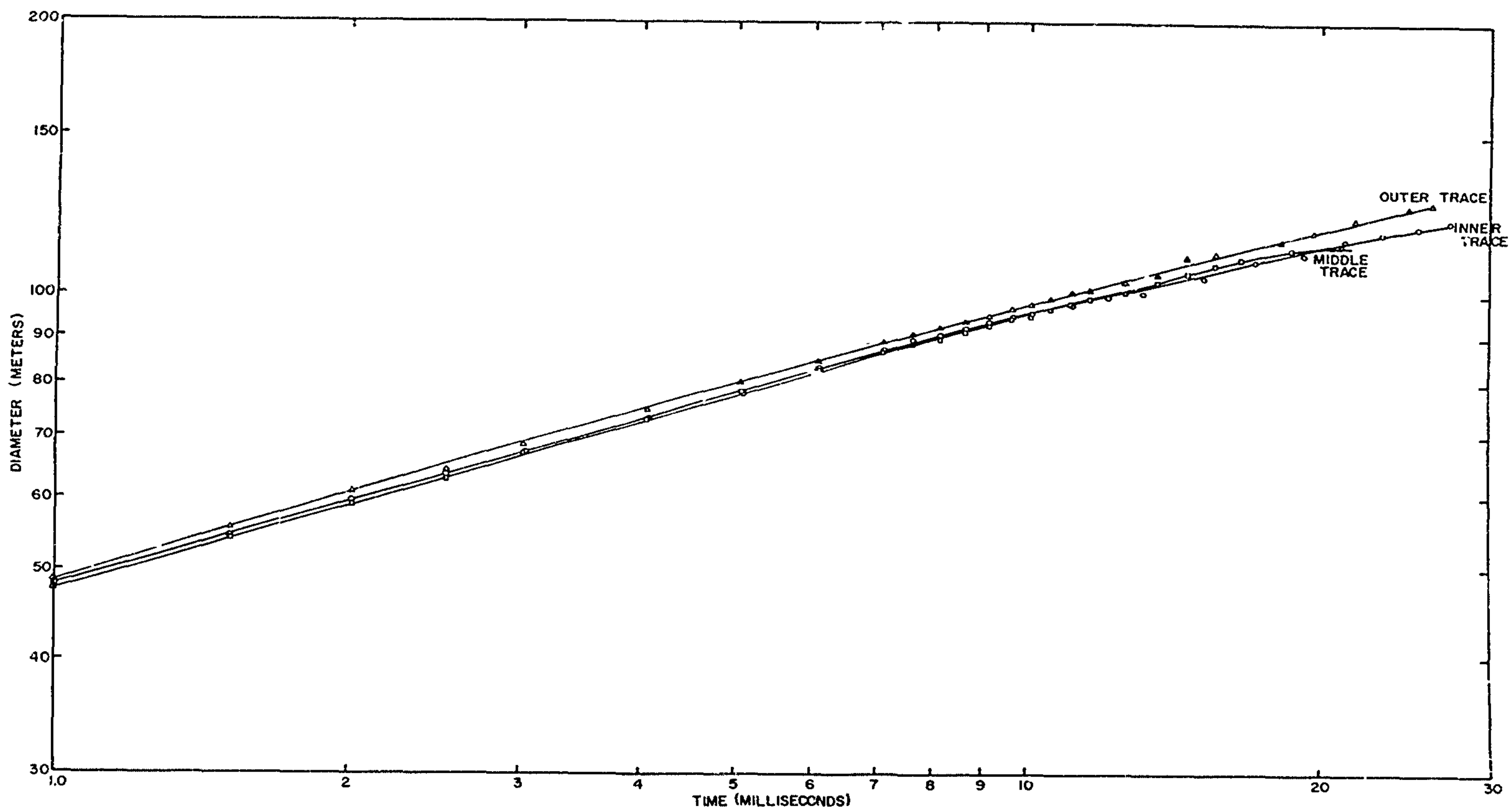

Fig. 7.3—Disc camera record of fireball diameter vs time, TS-2, 15 April 1952.

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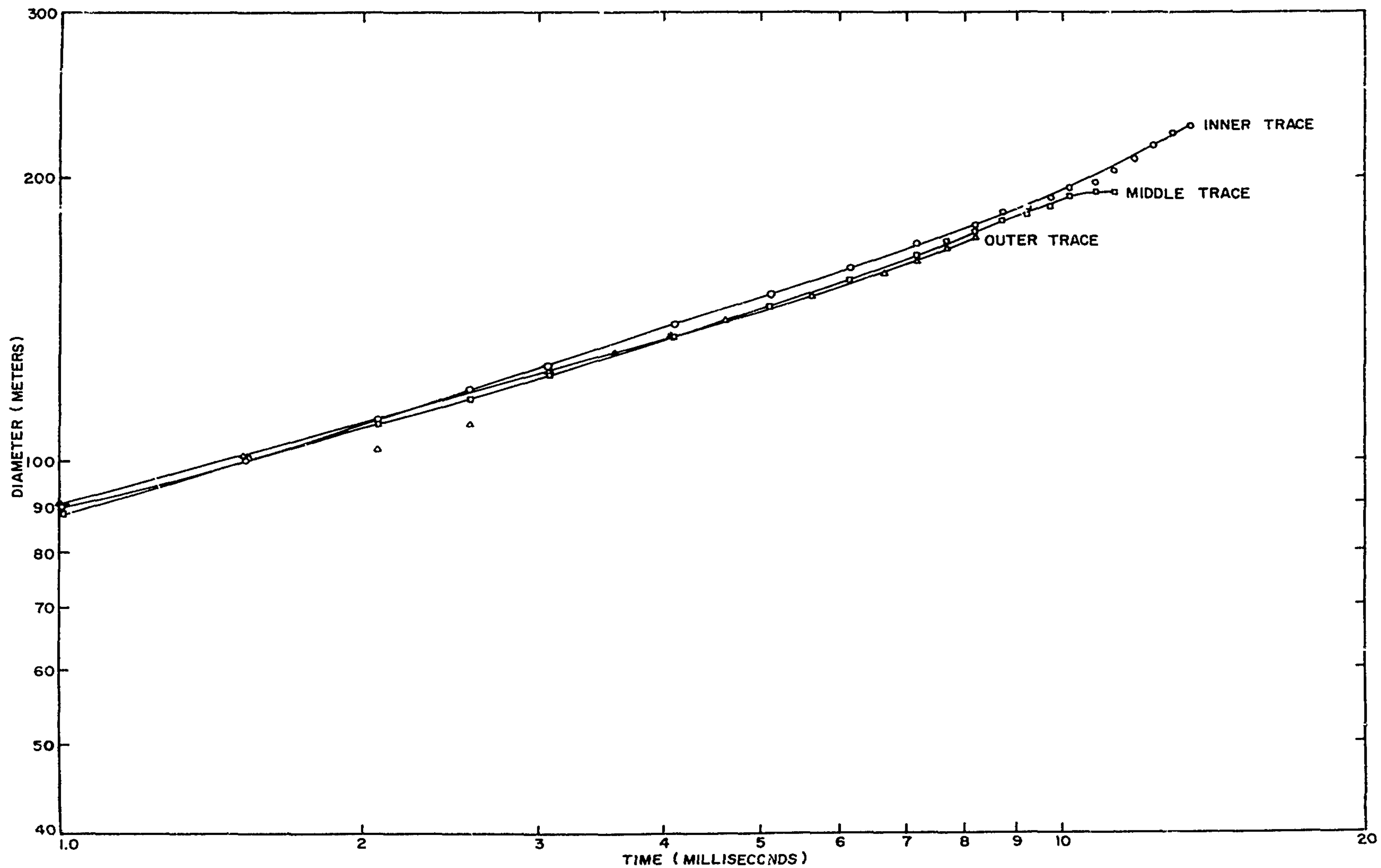

Fig. 7.4—Disc camera record of fireball diameter vs time, TS-3. 22 April 1952.

[redacted]

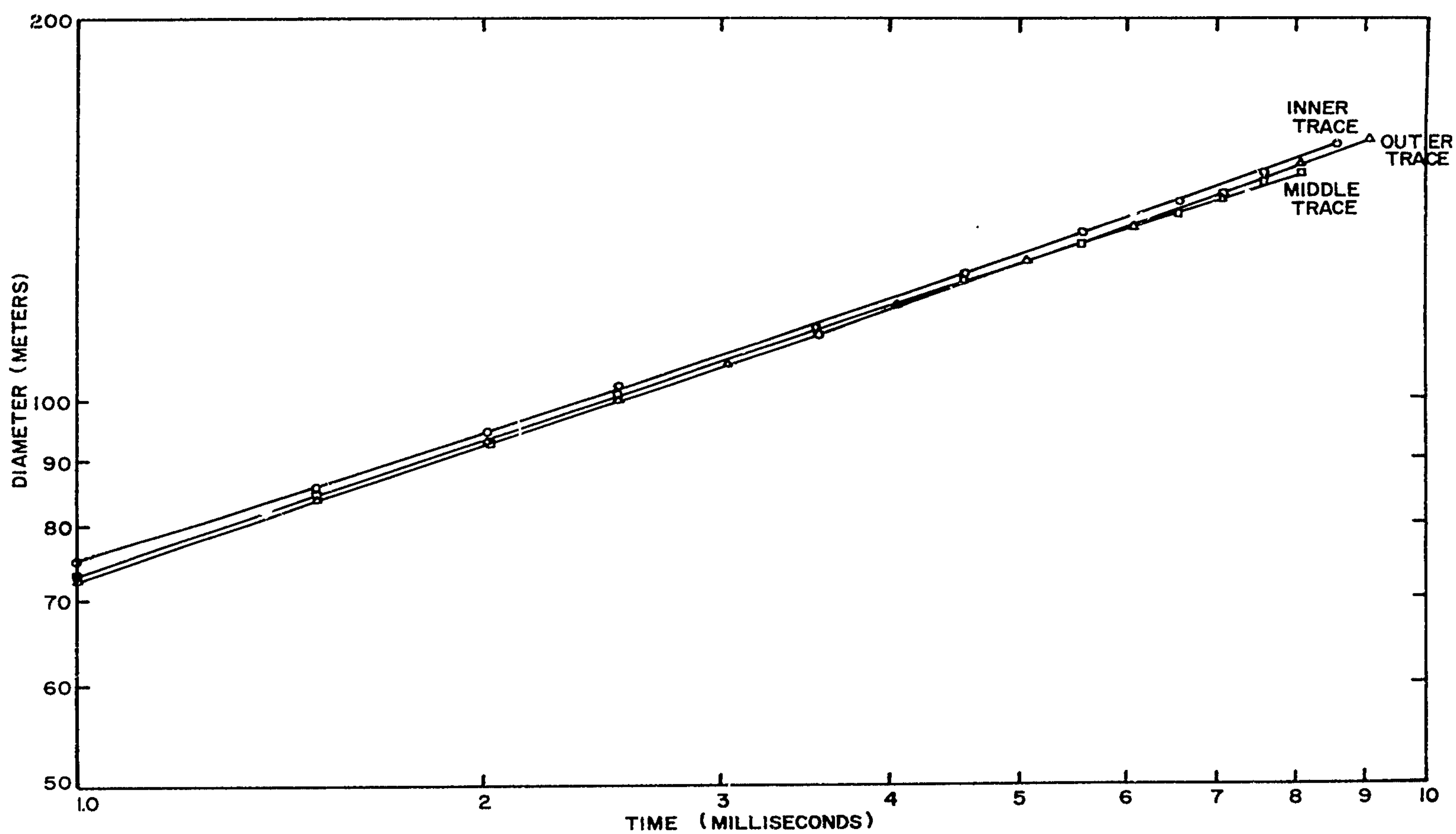

Fig. 7.5—Disc camera record of fireball diameter vs time, TS-4. 1 May 1952.

[redacted]

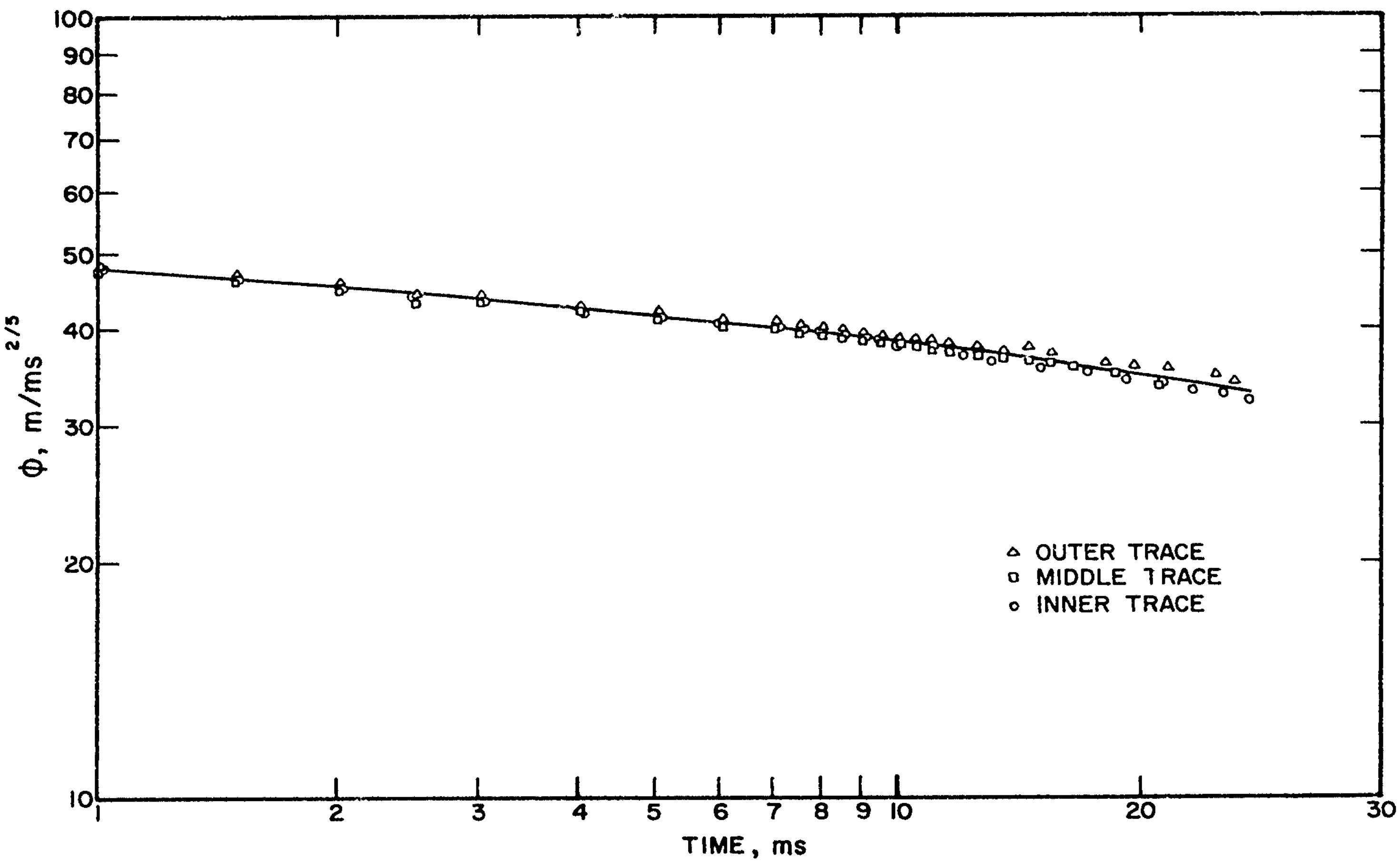

Fig. 7.6—Disc camera record of ϕ vs time, TS-2.

[redacted]

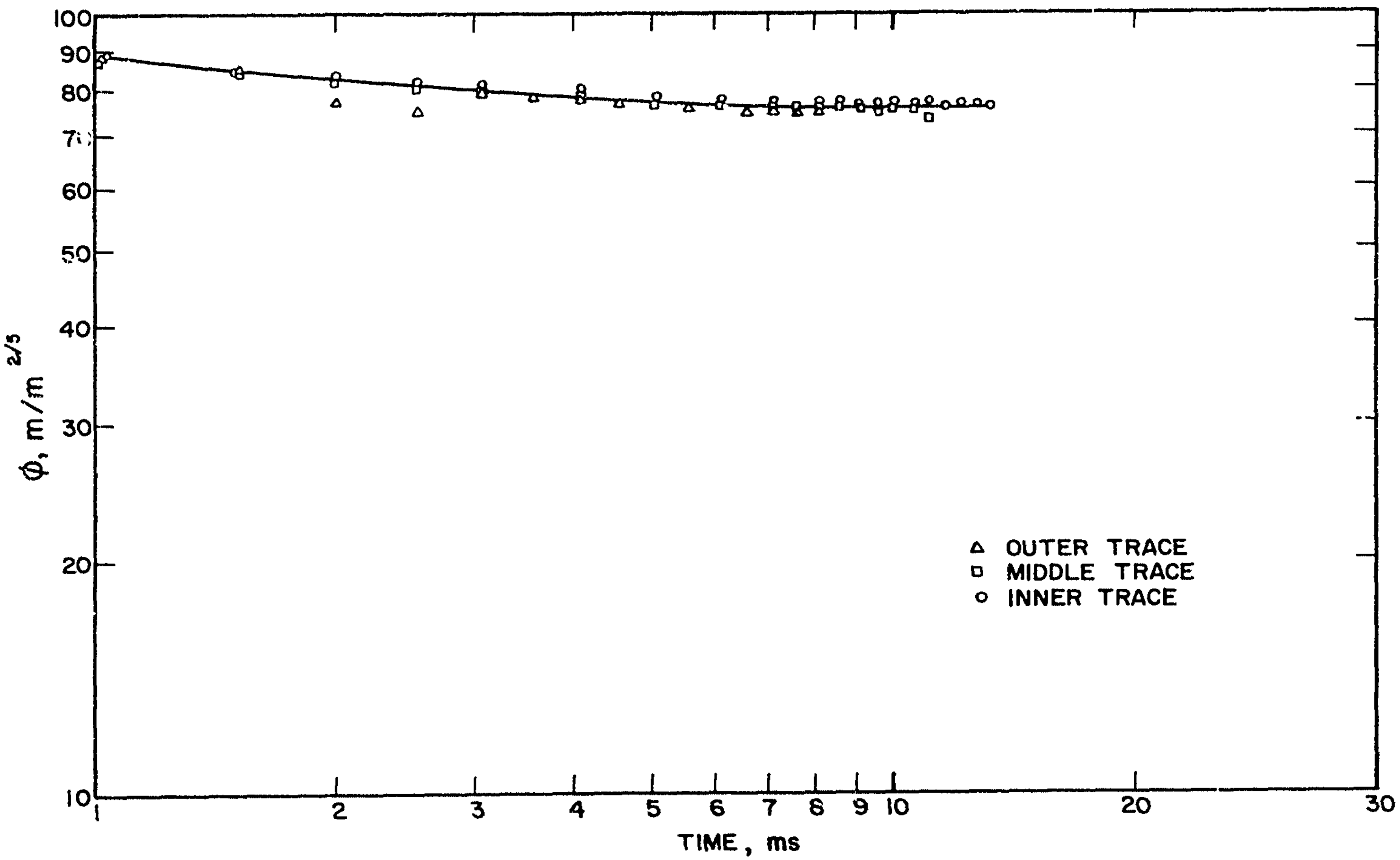

Fig. 7.7—Disc camera record of ϕ vs time, TS-3.

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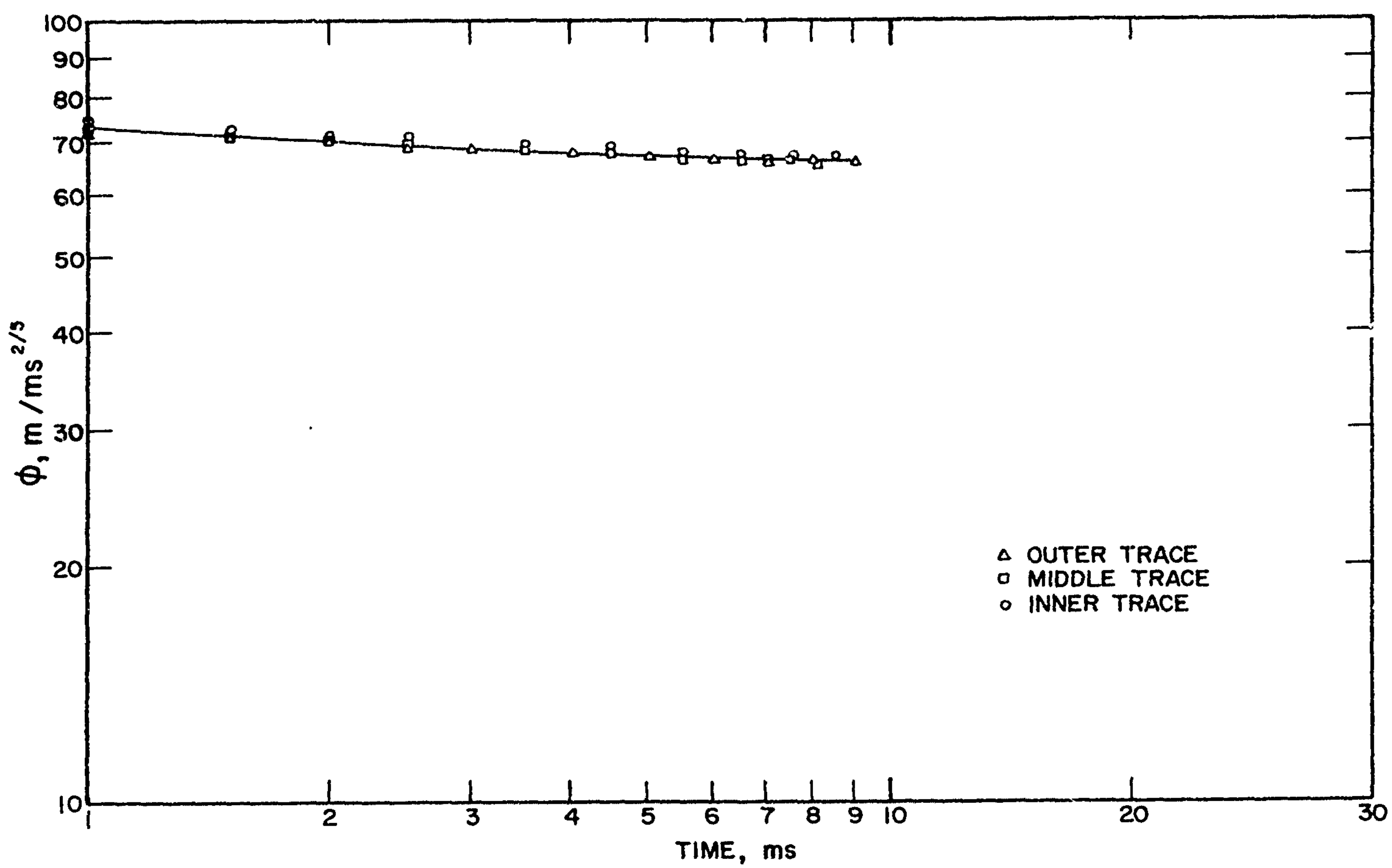

Fig. 7.8—Disc camera record of ϕ vs time, TS-4.

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APPENDIX A

CAMERA DATA SHEETS

[redacted]

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CAMERA DATA SHEET

TEST H.E. Drop **DATE** 3/30/52 **STA.** F-360
Tumbler 09:30 Truck 1

REMARKS & NOTES	CAMERA			TIME	LENS	
~ FR./SEC.	NO.	SERIAL	MAG.	OPER.	FOC. LGH.	SERIAL
770	E-17	1496			152 mm	RC273
	20	1525				315
	21	1519				257
	10	1515				358
	26	1518				334
	27	1514				253
3000	7	1443			63	ET1229
	12	1512				1207
	18	1517				1253
770	11	1521			25	RY175
	W-148	148			165	148
	K-328				480	774528

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CAMERA DATA SHEET

TEST H.E. Drop Tumbler DATE 3/30/52 STA. F360 Truck 1

PERF. CODE	EMULS.	FILTERS ND	FILTERS COLOR	APER. SET.	AIMING HORIZ.	AIMING VERT.	POWER	TIMING ON	TIMING OFF	MARKERS, SERIALS FM.	MARKERS, SERIALS VEL.	MARKERS, SERIALS ZERO	RACK POS.	CAM NO.
12278	S-XX	0	0	4	13°-07'L	0°-36'	120VDC 13.5Ω	-2.55	self	25	200-4	4	A	E-17
77	BX				11-27						10	10	B	20
76	S-XX				9-45						9	9	C	21
75	BX				8-03						4	4	D	10
74	MF				6-21						10	10	E	26
73	"				4-39						9	9	F	27
00	Neg. Pan				0-00	5°-07'	40/80				4	4	G	7
01	"							-1.5			10	10	H	12
02	"							-0.5			9	9	I	18
13	ECN			2.8			13.5Ω	-2.5			10	10	L	11
12235	MF	C	12	32	0-00	Level	24VDC	BB	self	4	–	–	Apron	W-148
37	"	"	0	22	"	"	"	"	"	1	–	–	"	K-528

[redacted]

EDGERTON, GERMESHAUSEN & GRIER, INC.

CAMERA DATA SHEET

TEST HE Drop Tumbler DATE 3/30/52 09:30 STA. F-361 Trailer 4

REMARKS & NOTES		CAMERA			TIME	LENS	
	~ FR./SEC.	NO.	SERIAL	MAG.	OPER.	FOC. LGH.	SERIAL
Raise front 15% frgnd.	100	MH-7	742			400	52236
		3	734			"	52237
		2	747			"	52238
		4	745			75	BS1712
		8	744			"	BS1984
		BH-5				25	279097
		R-8	8		5040 μs	480	773944
		10	10		4000		3961
		26	26		10		4696
		31	31		30		3948
		9	9		100		4694
		33	33		403		3950
		5	5		30		3956
		6	6		50		3949

[redacted]

EDGERTON, GERMESHAUSEN & GRIER, INC.

CAMERA DATA SHEET

TEST H.E. Drop Tumbler DATE 3/30/52 09:30 STA. F-361 Trailer 4

PERF. CODE	EMULS.	FILTERS ND	FILTERS COLOR	APER. SET.	AIMING HORIZ.	AIMING VERT.	POWER	TIMING ON	TIMING OFF	MARKERS, SERIALS FM.	MARKERS, SERIALS VEL.	MARKERS, SERIALS ZERO	RACK POS.	CAM NO.
12270	MF	0	0	5 170°	17°-21'L	level	120VDC	-15S	+45S	—	100-3	—	Q	MH-7
71					14-00						3		P	3
72					0-00	Raise Front					1		O	2
81				2.3							3		N	4
82											3		PP	8
19						16°30'					1		QQ	BH-5
NONE	NONE	0	0	11	0-00	5°02'	115AC 24DC	-15m	+3S	24	—	—	R	R-8
								-2.5S		24			S	10
										10			T	26
										24			U	31
										24			V	9
										10			W	33
										10			X	5
										10			Y	6

[redacted]

EDGERTON, GERMESHAUSEN & GRIER, INC. **CAMERA DATA SHEET**

TEST HE Drop Tumbler **DATE** 3/30/52 09:30 **STA.** F-362 Vehicles 2 & 5

REMARKS & NOTES	CAMERA			TIME	LENS	
~ FR./SEC.	NO.	SERIAL	MAG.	OPER.	FOC. LGH.	SERIAL
3000	E-8	1445			63mm	ET1254
"	15	1494			"	RC606
770	1	1454			152	RC245
3000	16	1513			63	ET1245
"	9	1493				RC622
770	2	1317				RC549
3000	25	1520				ET1223
"	24	1522				RC539
770	4	1321			25	RY165
"	6	1318			"	RY187
30 FT/S	GR-2				—	—
	W-147	147			165	147
	K-529				480	774529
100	MH-1	748			75	BS1764
	5	743			75	BS1805
	BH-2	1093			25	281674
	3	1095			100	282354
30 FT/S	GR-5	667			NONE	NONE
"	6	669			"	"
	R-14	14			480	
	24	24				
	4	4				
	19	19				
	18	18				
	29	29				
	12	12				
	17	17				

[redacted]

EDGERTON, GERMESHAUSEN & GRIER, INC.

CAMERA DATA SHEET

TEST HE DROP Tumbler DATE 3/30/52 09:30 STA. F-362 VEHICLES 2&5

PERF. CODE	EMULS.	FILTERS ND	FILTERS COLOR	APER. SET.	AIMING HORIZ.	AIMING VERT.	POWER	TIMING ON	TIMING OFF	MARKERS, SERIALS FM.	MARKERS, SERIALS VEL.	MARKERS, SERIALS ZERO	RACK POS.	CAM NO.
12203	MF	0	0	2.8	0°-00'	4°-30'	120V 40/80	-2.5S	SELF				A	E-8
04				"		"	"	"					B	15
14				4		1°-06'	13.5Ω	"					C	1
05				2.8		4°-30'	40/80	-1.5					D	16
06						"	"	"					E	9
15						2°50'	13.5Ω	-2.5					F	2
07						4°-30'	40/80	-0.5					G	25
08							"	"					H	24
16					6°51'L		13.5Ω	-2.5					I	4
17					"		"	"					L	6
27	S-XX	Step		—	0-00	LEVEL	—	"	+3S				K	GR-2
12236	MF	0	12	24	0-00	LEVEL	24VDC	BB 1/200	SELF		–	–	Apron	W-147
38	"	"	0	22	"	"	"	"	"		–	–	"	K-529
12283	MF	0	0	2.3 170°	6°51'L	LEVEL	120V	-15S	+45S	—	100-5	—	P	MH-1
84						RAISE FRONT							PP	5
20						17°-00'							Q	BH-2
21					0-00	3°-00'							QQ	3
28	S-XX	Step		—		LEVEL		-2.5S	+3S		200-2		N	GR-5
29	"	"		—		"		"			"		O	6
NONE	NONE	0	0	11		4°30'	115VAC 24VDC	-15m			—		R	R-14
								-2.5S					S	24
													T	4
													U	19
													V	18
													W	29
													X	12
													Y	17

[redacted]

EDGERTON, GERMESHAUSEN & GRIER, INC.

CAMERA DATA SHEET

TEST Dry Run DATE 3/27/52 STA. F-D' 5T
H.E. 10:00

REMARKS & NOTES ~FR./SEC.	CAMERA NO.	CAMERA SERIAL	CAMERA MAG.	TIME OPER.	LENS FOC. LGH.	LENS SERIAL
All shutters set at 60° opening	MAS-27				35mm	
(Exposure = 1/3 of frame interval)	22					
	19					
	6					
	18					
	3					
	17					
	9					
	23					
	16					
	25					
	20					
	HE SHOT					
SHELTER	MAS-26				35mm	
"	5					
TOWER	16					

[redacted]

EDGERTON, GERMESHAUSEN & GRIER, INC. CAMERA DATA SHEET

TEST Dry Run & H.E DATE 3/27/57 10:00 STA. F-Dust

PERF. CODE	EMULS.	FILTERS ND	FILTERS COLOR	APER. SET.	AIMING HORIZ.	AIMING VERT.	POWER	TIMING ON	TIMING OFF	MARKERS, SERIALS FM.	MARKERS, SERIALS VEL.	MARKERS, SERIALS ZERO	RACK POS.	CAM NO.
12096	MF	0	0	2.3	F200	LEVEL	24VDC	-4S	+175	—	2-5	—	F363	MAS-27
87					"						5		"	22
92					F202						6		364	19
91					"						6		"	6
94					F204						3		365	18
97					"						3		"	3
98					F206						7		366	17
93					"						7		"	9
95					F208						8		367	23
86					"						8		"	16
89					F210						9		368	25
98	↓	↓	↓	↓	"	↓	↓	↓	↓	↓	9	↓	"	20
12286	MF	0	0	2.3	F208	LEVEL	24VDC	-4S	+175	—	2-8	—	F208	MAS-26
86														5
87	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	16

EDGERTON, GERMESHAUSEN & GRIER, INC.

CAMERA DATA SHEET

TEST TS-1 DATE 4/1/52 STA. F-361
09:00 TRAILER 4

REMARKS & NOTES	~FR./SEC.	CAMERA NO.	CAMERA SERIAL	CAMERA MAG.	TIME OPER.	LENS FOC. LGH.	LENS SERIAL
Raise Front 15% FRGND. PURPOSE S.P. 9	100	MH-7	742			400mm	52236
S.F. 8		3	734				52237
UNDER EXPOS. ~12 FR. GND. STRIKE		2	747				52238
ROCKETS		4	745			75	BS1712
"		8	744			"	BS1984
TILT CLOUD		BH-5	1096			25	279097
YIELD		R-8	8		5040 μs	480	773944
"		10	10		4000		3961
F.B.		26	26		11.0		4696
		31	31		32.2		3948
		9	9		99.8		4694
		33	33		403		3950
SPECTR.		5	5		29.7		3956
"		6	6		50.3		3949

[redacted]

EDGERTON, GERMESHAUSEN & GRIER, INC.

CAMERA DATA SHEET

TEST TS-1 DATE 4/1/52 09:00 STA. F-361 TRAILER 4

PERF. CODE	EMULS.	FILTERS ND	FILTERS COLOR	APER. SET.	AIMING HORIZ.	AIMING VERT.	POWER	TIMING ON	TIMING OFF	MARKERS, SERIALS FM.	MARKERS, SERIALS VEL.	MARKERS, SERIALS ZERO	RACK POS.	CAM NO.
13070	MF	0	0	6.3 170°	17°-21'L	0°17'	120VDC.	-15S	+45S	—	100-3	—	Q	MH-1
71	ECN	"	"	8 170°	14-00L	0°11'					3		P	3
72	MF	1	12	11 15°	0-00	0°33'					1		O	2
81		0		8 15°		LEVEL					3		N	4
82				4 15°		"					3		PP	8
19	ECN		0	4 120°		16°30'					1		QQ	5
13053	TRI-X	0	0	11	0-00	5°02'	115AC	-15M	+3S	24	—	—	R	R-8
54	"						24DC	-25S		24			S	10
45	HRHS									10			T	26
46	"									24			U	31
41	MF									24			V	9
42	"									10			W	33
49	EKTA		CC40M							10			X	5
50	"		"							10			Y	6

[redacted]

EDGERTON, GERMESHAUSEN & GRIER, INC.

CAMERA DATA SHEET

TEST TS-1 DATE 4/1/52 STA. F-360
09:00 TRUCK 1

REMARKS & NOTES	PURPOSE	~FR./SEC.	CAMERA NO.	CAMERA SERIAL	CAMERA MAG.	TIME OPER.	LENS FOC. LGH.	LENS SERIAL
TOO HEAVY EXPOS.	S.P. 7+8	8-10S RUNNING	E-17	1496		1-2-3+	152	RC273
" "	6+7		20	1525				313
TOO " "	5+6		21	1519				257
" "	4+5		10	1515				358
O.K. "	3+4		26	1518				334
" "	2+3		27	1514				253
	F.B.	3000	7	1443		1st SEQ.	63	ET1229
	F.B.		12	1512		2nd "		1207
	F.B.		18	1517		3rd "		1253
	SHOCK	8-10S RUNNING	11	1521		1-2-3+	25	RY175
	SURVEY	SHUTTER 1/200S	W-148	148			165	148
	"	" 1/150S	K-528				480	774528

[redacted]

EDGERTON, GERMESHAUSEN & GRIER, INC. CAMERA DATA SHEET

TEST TS-1 DATE 4/1/52 STA. F-360

09 00 TRUCK 1

PERF. CODE	EMULS.	FILTERS ND	FILTERS COLOR	APER. SET.	AIMING HORIZ.	AIMING VERT.	POWER	TIMING ON	TIMING OFF	MARKERS, SERIALS FM.	MARKERS, SERIALS VEL.	MARKERS, SERIALS ZERO	RACK POS.	CAM NO.
13078	S-XX	0	0	4	13°-07' L	0°-36'	120 DC Shunt	-2.5 S	SELF +4 S	23	200-4	4	A	E-17
77	BX		0		11-27						10	10	B	20
76	S-XX		12		9-45						9	9	C	21
75	BX				8-03						4	4	D	10
74	MF				6-21						10	10	E	26
73					4-39						9	9	F	27
00				8	0-00	5°-07'	40/80				4	4	G	7
01								-1.5			10	10	H	12
02								-0.5			9	9	I	18
13	ECP		0	4			Shunt	-2.5			10	10	L	11
13035	MF	0	12	32	0-00	LEVEL	24 VDC	BB	SELF	TSP 4	—	—	Apron	W-14B
37	"	1	12	22	"	"	"	"	"	TSP 1	—	—	"	K-52B

[redacted]

EDGERTON, GERMESHAUSEN & GRIER, INC.

CAMERA DATA SHEET

TEST TS-1 DATE 4/1/52 STA. F-362
09:00 Truck 2 & Trailer 5

REMARKS & NOTES		CAMERA			TIME	LENS	
PURPOSE	~FR./SEC.	NO.	SERIAL	MAG.	OPER.	FOC. LGH.	SERIAL
YIELD	3000	E-8	1445		1st SEQ.	63 mm	ET1254
"	"	15	1494		"	"	RC606
STEM	8-10s RUNNING	1	1454		1-2-3+	152	RC245
YIELD	3000	16	1513		2nd SEQ.	63	ET1245
"	"	9	1493		"		RC622
COLOR	8-10s RUNNING	2	1317		1-2-3+		RC549
YIELD	3000	25	1520		3rd SEQ.		ET1223
"	"	24	1522		"		RC539
SHOCK	8-10s RUNNING	4	1321		1-2-3+	25	RY165
"	"	6	1318		"	"	RY187
ND 0,0.5,1.0,1.5,2.3,3.0 LIGHT (T)	30 1/s	GR-2	581		"	—	—
SURVEY	SHUTTER 1/200s	W-147	147		—	165	147
"	" 1/150s	K-529	41-1194		—	480	774529
ROCKETS	100	MH-1	748		—	75	B51764
"		5	743			75	B51805
CLOUD		BH-2	1093			25	281674
STEM		3	1095			100	282345
N.D. 0,0.5,1.0,1.5,2.0,3.0 LIGHT (T)	30 1/s	GR-5	667			—	—
" " "		6	669			—	—
YIELD		R-14	14		3000 μs	480	77395[illegible]
"		24	24		2632		3958
F.B.		4	4		17.7		3947
"		19	19		49.9		2890
"		18	18		812		3955
"		29	29		780		3954
SPECTR.		12	12		36.3		3960
"		17	17		80.0		3951

[redacted]

EDGERTON, GERMESHAUSEN & GRIER, INC.

CAMERA DATA SHEET

TEST TS-1 DATE 4/1/52 STA. F-362
09:00 Truck 2 Trailer 5

PERF. CODE	EMULS.	FILTERS ND	FILTERS COLOR	APER. SET.	AIMING HORIZ.	AIMING VERT.	POWER	TIMING ON	TIMING OFF	MARKERS, SERIALS FM.	MARKERS, SERIALS VEL.	MARKERS, SERIALS ZERO	RACK POS.	CAM NO.
13003	MF	0	12	4	0°-00'	4°30'	120V 40/80	-2.55	SELF	22	200-8	8	A	E-8
04	"	1	12	5.6		"	"	"			7	7	B	15
14	ECP	1	0	5.6		1°-06'	SHUNT	"			12	12	C	1
05	MF	0	12	4		4°30'	40/80	-1.5			8	8	D	16
06	"	1	12	5.6		"	"	"			7	7	E	9
15	ECP	2	0	5.6		2°50'	SHUNT	-2.5			12	12	F	2
07	MF	0	12	4		4°-30'	40/80	-0.5			8	8	G	25
08	"	1	12	5.6			"	"			7	7	H	24
16	ECN	1	0	4	6°-51'L		SHUNT	-2.5			12	12	I	4
17	"	2	0	4	"		"	"			8	8	L	6
27	S-XX	Step #4	12	—	0-00	LEVEL	—	"	+3S		12	12	K	GR-2
13036	MF	0	12	24	0-00	LEVEL	24VDC	B.B	SELF	TSP 5	—	—	Apron	W-147
38	"	1	12	22	"	"	"	"	"	TSP 3	—	—	"	K-529
13083	MF	0	12	4 15°	6°-51L	LEVEL	120VDC	-15S	+45S	—	100-5	—	P	MH-1
84	"		"	8 15°	"								PP	5
20	ECN		0	11 170°	"	17°-00'							Q	BH-2
21	"		"	11 30°	0°-00	4°40'							QQ	3
28	SXX	Step #10	47	—		LEVEL		-2.5S	+3S		200-2		N	GR-5
29	IR	Step #12	89B	—		"		"			"		O	6
55	TRI-X	0	0	11		4°-30'	115VAC 24VDC	-15m		16	—		R	R-14
47	HRHS							-2.5S					S	24
48	"												T	4
43	MF												U	19
44	"												V	18
56	HRHS									29			W	29
51	ECP												X	12
52	"												Y	17

[redacted]

EDGERTON, GERMESHAUSEN & GRIER, INC.

CAMERA DATA SHEET

TEST TS-1 DATE 4/1/52 STA. E-DUST 09:00

REMARKS & NOTES	CAMERA			TIME	LENS	
~ FR./SEC.	NO.	SERIAL	MAG.	OPER.	FOC. LGH.	SERIAL
ALL SHUTTERS AT 60° - (1/3 FR. INTERVAL EXPOSURE)	MAS-27		27-1		35mm	765260
	22		22-1			764 794
	6		18-2			764 805
	19		19-1			763 975
	18		18-1			764 810
	3		3-2			378
	9		9-1			765257
	1		1-1			763770
TOWER	26		26-2			763970
FILM JAMMED - DID NOT RUN	5		5-1			995
	16		16-1			764793
	25		25-1			788
FILM JAMMED - DID NOT RUN	20		20-1			
POLE	17		17-1			763977

VELOCITY MARKER CALIBRATION

MARKER*	VELOCITY (CPS)
3	1.95
5	1.95
6	1.93
7	1.95
8	1.97
9	1.97

[redacted]

EDGERTON, GERMESHAUSEN & GRIER, INC. CAMERA DATA SHEET

TEST TS-1 DATE 4/1/52 09:00 STA. F-DUST

PERF. CODE	EMULS.	FILTERS ND	FILTERS COLOR	APER. SET.	AIMING HORIZ.	AIMING VERT.	POWER	TIMING ON	TIMING OFF	MARKERS, SERIALS FM.	MARKERS, SERIALS VEL.	MARKERS, SERIALS ZERO	RACK POS.	CAM NO.
13085	MF	0	0	2.3	F200	+1°	24VDC	-14S	+7S	—	2-5	—	F363	MAS-27
86				11	"	"					"		"	22
87				2.3	F202	0					2-6		F364	6
88				11	"	"					"		"	19
89				2.3	F204	+1°					2-3		F365	18
90				8	"	"					"		"	3
91				2.3	F206	0		-4S	+17S		2-7		F366	9
92				8	"						"		"	1
94				2.8	F208						2-8		F367	26
93				5.6	"						"		"	5
95				2.3	"						"		"	16
96				2.3	F210						2-9		F368	25
97				5.6	"						"		"	20
98				2.6	"						"		"	17

EDGERTON, GERMESHAUSEN & GRIER, INC.

CAMERA DATA SHEET

TEST TS-2 DATE 4-15-52 STA. 7-360

09:29 57 05 TRUCK 1

REMARKS & NOTES			CAMERA			TIME	LENS	
ET	PURPOSE	~FR./SEC.	NO.	SERIAL	MAG.	OPER.	FOC. LGH.	SERIAL
0	GND. STRIKE	500	E-17	1496		1-2-3+	152 mm	RC273
750	MJ 1		20	1525				313
3750	5		21	1519				257
3000	4		10	1515				358
2250	3		26	1518				334
1500	2		27	1514				253
	YIELD	3000	7	1443		1st SEQ.	63	ET1229
			12	1512		2nd "		1207
			18	1517		3rd "		1253
	COLOR	500	11	1521		1-2-3+	25	RY175
	SURVEY	1/200 SEC	W-148	148			165	148
	"	1/150 SEC	K-528	—			480	774528

[redacted]

EDGERTON, GERMESHAUSEN & GRIER, INC.

CAMERA DATA SHEET

TEST TS-2 DATE 4/15/52 STA. 7-360

09:29:57 05 TRUCK 1

PERF.	EMULS.	FILTERS		APER.	AIMING		POWER	TIMING		MARKERS, SERIALS			RACK	CAM
CODE		ND	COLOR	SET.	HORIZ.	VERT.		ON	OFF	FM.	VEL.	ZERO	POS.	NO.
13178	MF	0	12	4	0°-00'	LEVEL	120DC SHUNT	-2.55	SELF	23	200-4	4	A	E-17
77	"			"	3-20L						10	10	B	20
76	BX			5.6	16-00L						9	9	C	21
75	"				12-48L						4	4	D	10
74	"				9-25L						10	10	E	26
73	"				6-30L						9	9	F	27
00	MF			8	0-00	3°37'	40/80				4	4	G	7
01	"							-1.5			10	10	H	12
02	"							-0.5			9	9	I	18
13	ECN	1	0	5.6		4°30'	SHUNT	-2.5			10	10	L	11
13135	MF	0	12	32	0-00	LEVEL	24VDC	TSP	SELF	TSP 1	—	—	Apron	Y-149
37	"	1	"	22	"	"	"	"	"	TSP 4	"	"	"	K-528

[redacted]

EDGERTON, GERMESHAUSEN & GRIER, INC.

CAMERA DATA SHEET

TEST TS-2 DATE 4-15-52 STA. 7-361

09:29:57.05 Truck 2 & Trailer 4

REMARKS & NOTES			CAMERA			TIME	LENS	
	PURPOSE	~FR./SEC.	NO.	SERIAL	MAG.	OPER.	FOC. LGH.	SERIAL
	YIELD	3000	E-8	1445		1st SEQ.	63mm	ET1254
	"	"	15	1494		"	"	RC606
	STEM	500	1	1525		1-2-3+	152	RC245
	YIELD	3000	16	1513		2nd SEQ.	63	ET1245
	"	"	9	1493		"		RC622
(ROCKETS)	SHOCK	500	2	1317		1-2-3+		RC549
	YIELD	3000	25	1520		3rd SEQ.		ET1223
	"	"	24	1522		"		RC539
	SHOCK	500	4	1321		1-2-3+	25	RY165
	COLOR	"	6	1318			"	RY187
N.D. 0,0.5,1.0,1.5,2,3,3.0	LIGHT(T)	30 1/s	GR-2	581			—	—
RAISE FRONT	ROCKETS	100	MH-4	745		—	100mm	BF8525
" "	"		8	744			75	BS1984
	CLOUD		BH-5	1096			25	279097
	YIELD		R-8	8		5025	480	773944
	"		10	10		4095		3961
	FIREBALL		26	26		11.8		4696
			31	31		31.7		3948
			9	9		103		4694
			33	33		411		3950
	SPECTR.		5	5		7495		3956
	"		6	6		53.2		3949

EDGERTON, GERMESHAUSEN & GRIER, INC.

CAMERA DATA SHEET

TEST TS-2 DATE 4-15-52 STA. 7-361
09:29:57.05 Truck 2 & Trailer 4

PERF. CODE	EMULS.	FILTERS ND	FILTERS COLOR	APER SET.	AIMING HORIZ.	AIMING VERT.	POWER	TIMING ON	TIMING OFF	MARKERS, SERIALS FM.	MARKERS, SERIALS VEL.	MARKERS, SERIALS ZERO	RACK POS.	CAM NO.
13103	MF	0	12	4	0°-00'	3°-30'	120DC 40/80	-2.5S	SELF	2c	200-8	8	A	E-8
04		1		5.6		"	"				7	7	B	15
80		0		8		0°-40'	SHUNT				12	12	C	1
05		0		4		3-30	40/80	-1.5			8	8	D	16
06		1		5.6		"	"	"			7	7	E	9
79		0	47	4	3°28L	0-40'	SHUNT	-2.5			12	12	F	2
07		0	12	4	0°-00	3-30	40/80	-0.5			8	8	G	25
08		1		5.6		"	"	"			7	7	H	24
14		0		4		5-10	SHUNT	-2.5			12	12	I	4
15	ECN	1	0	4	5°-56'L	"	"				8	8	L	6
27	S-XX	Step #4	12	—	0-00	LEVEL	—		+3S		12	12	K	R-2
13181	MF	0	12	3 30°	0°-00'	LEVEL	120DC	-15S	+45S	—	100-1	—	O	MH-4
82	"		"	4 45°		"					6		N	8
19	ECN		0	4 120°		16°					6		P	BH-5
53	TRI-X			11		3°-30'	115AC 24DC	15m	+3S	24	—		R	R-8
54	"							-2.5S		"			S	10
45	HRHS									10			T	26
46	"									24			U	31
41	MF									"			V	9
42	"									10			W	33
49	EKTA												X	5
50	ECP	0.5	85B										Y	6

[redacted]

EDGERTON, GERMESHAUSEN & GRIER, INC.

CAMERA DATA SHEET

TEST TS-2 DATE 4-15-52 STA. 7-362

09:29:57.05 Trailer 5

REMARKS & NOTES			CAMERA			TIME	LENS	
	PURPOSE	~FR./SEC.	NO.	SERIAL	MAG.	OPER.	FOC. LGH.	SERIAL
RAISE FRONT	ROCKETS	100	MH-1	748			75mm	BS1764
" "	"		5	743			50	LF6935
	CLOUD		BH-2	1093			25	281674
	STEM		3	1095			152	BF2355
N.D 0,0.5,1.0,1.5,2.0,3.0	LIGHT (T)	30/s	GR-5	667			—	—
" "	"	"	6	669			—	—
	YIELD		R-14	14		2990	480	773952
	"		24	24		2615		3958
	FIREBALL		4	4		18.3		3947
			19	19		49.6		2890
			13	18		205		3955
			29	29		773		3954
	SPECTR.		12	12		40.5		3960
	"		17	17		84		3951
	SURVEY	1/200 SEC.	W-147	147			165	147
	"	1/150 SEC.	K-529	41-1194			480	774529

[redacted]

EDGERTON, GERMESHAUSEN & GRIER, INC.

CAMERA DATA SHEET

TEST TS-2 DATE 4-15-62 STA. 7-362
09:29:57.05 TRAILER 5

PERF. CODE	EMULS.	FILTERS ND	FILTERS COLOR	APER. SET	AIMING HORIZ.	AIMING VERT.	POWER	TIMING ON	TIMING OFF	MARKERS, SERIALS FM.	MARKERS, SERIALS VEL.	MARKERS, SERIALS ZERO	RACK POS.	CAM NO.
13183	MF	0	12	B 30°	7°57'L	LEVEL	120 DC	-15s	+45s	—	100-5	—	P	MH-1
84	"		"	4 45°		"							PP	5
20	ECN		0	5.6 120°		16°-00'							Q	BH-2
21	"		"	11 20°	0-00	3°-00'							QQ	3
28	S-XX	Step #10	47	—		LEVEL		-2.5s	+3s		200-2		N	GR-5
29	IR	Step #12	89B	—		"		"			"		O	6
55	TRI-X	0	0	11		4°47'	115AC 24DC	-15m		16	—		R	R-14
47	HRHS							-2.5s					S	24
48	"												T	4
43	MF												U	19
44	"												V	18
56	HRHS									29			W	29
51	ECP		85B										X	12
52	"	0.5	"										Y	17
13136	MF	0	12	24	0-00	LEVEL	24DC	TSP	SELF	TSP 3	—	—	Apron	W-497
38	"	1	"	22	"	"	"	"	"	TSP 2	—	—	"	K-529

EDGERTON, GERMESHAUSEN & GRIER, INC.

CAMERA DATA SHEET

TEST TS-2 DATE 4-15-52 STA: 7-248 ¢
08:29:57.05 Dust & Cloud

REMARKS & NOTES			CAMERA			TIME	LENS	
	PURPOSE	~FR./SEC.	NO.	SERIAL	MAG.	OPER.	FOC. LGH.	SERIAL
~ 4/6 FR. LEFT OF ¢ FRONT RAISED	GND. SHOCK	100	KH-7	742			400	52236
" between ¢ 203 & 204 FRONT NOT RAISED	GUN		3	734				52237
" " 204 & 205 "	"		2	747				52238
VEL. MARK CALIB.	200	32	MAS-27				35	765260
VEL. MARK* VEL. (CPS)	"		22					764794
STA. 7-376 (J-6) 3 1.95	201	TWR	26					763970
AIM AT STA. 900 5 1.95	SHOCK	450 "	F16-3					460392
6 1.93	202	32	MAS-6					764805
8 1.97	"		19					763975
9 1.97	204		18					764810
10 1.98	"		28					762779
11 1.98	206		9					765257
	"		24					764807
* AIM 150' LEFT OF STA 204	SHOCK	900 POLE	FB-3	8C-12				460406
40 min PRISM – POLARIZED IN TWO DIRECTIONS			F8-14			—	254	876314
	RAISE FRONT CLOUD	24	ML-9	409			50-100	LF6989 BF9469
CAMERA NOT USED 1/200 SEC. EXP.		VARIES	K17-9	AC44 190810			152	MF1629
1/225 SEC.		"	K17-7	AC44 190767			304	EE3019
	RAISE FRONT CLOUD	24	ML-10	408			50 100	LF6969 BF9571
1/200 SEC. EXP		VARIES	K17-10	AC44 191117			162	MF2545
1/225 SEC.		"	K17-8	AC44 190874			304	EC314

[redacted]

EDGERTON, GERMESHAUSEN & GRIER, INC.

CAMERA DATA SHEET

TEST TS-2 DATE 4-15-52 STAs. 7-248, 09:29:57.05 DUST & CLOUD

PERF. CODE	EMULS.	FILTERS ND	FILTERS COLOR	APER. SET.	AIMING HORIZ.	AIMING VERT.	POWER	TIMING ON	TIMING OFF	MARKERS, SERIALS FM.	MARKERS, SERIALS VEL.	MARKERS, SERIALS ZERO	RACK POS.	CAM NO.
13170	MF	O	O	6.3 30°	0°40'L	LEVEL	115AC	-15S	+45S	—	100-3	—	248	MH-7
71	↓	↓	↓	↓ 90°	3°21'R*	+7°19'	↓	↓	↓	↓	↓	↓	↓	3
72	↓	↓	↓	↓ 170°	4°45'R*	+8°43'	↓	↓	↓	↓	↓	↓	↓	2
13185	MF	O	O	2.3	200	LEVEL	24 DC	-5S	+16S	—	2-6	—	363	MRS-27
86	↓	↓	↓	11	"	↓	↓	↓	↓	↓	6	↓	"	22
97	↓	↓	↓	8	201	↓	↓	↓	↓	↓	8	↓	375	26
98	↓	↓	↓	5.6	36°L	↓	12DC	-3S	↓	↓	11	↓	"	F16-3
87	↓	↓	↓	2.3	202	↓	24DC	-5S	↓	↓	3	↓	364	MRS-6
88	↓	↓	↓	5.6	"	↓	↓	↓	↓	↓	3	↓	"	19
89	↓	↓	↓	2.3	204	↓	↓	↓	↓	↓	5	↓	365	18
90	↓	↓	↓	4	"	↓	↓	↓	↓	↓	5	↓	"	28
91	↓	↓	↓	2.3	206	↓	↓	↓	↓	↓	9	↓	366	9
92	↓	↓	↓	4	"	↓	↓	↓	↓	↓	9	↓	↓	24
99	↓	↓	↓	5.6	6°30'L*	↓	12DC	-3S	↓	↓	10	↓	↓	F8-3
13109	MF	O	O	6.3	O	1°15'	30DC	-2S	+3S	—	200-	—	CP	F8-14
13122	ECN	O	O	8 90°	0°-00'	LEVEL	115VAC	-15S	BURSTS	—	—	—	358	ML-9
30	S-XX	↓	W25A	8	↓	+30'	24VDC	-5S	20m	↓	CLOCK	↓	↓	KT-9
31	"	↓	"	"	↓	+15°	"	"	"	↓	"	↓	↓	KT-7
13123	ECN	O	O	8 90°	0°-00'		115VAC	-15S	BURSTS	—	—	—	359	ML-10
32	S-XX	↓	W25A	8	↓	+30°	24DC	-5S	20m	↓	CLOCK	↓	↓	KT-10
33	"	↓	"	"	↓	+15°	"	"	"	↓	"	↓	↓	KT-8

[redacted]

EDGERTON, GERMESHAUSEN & GRIER, INC.

CAMERA DATA SHEET

TEST TS-3 DATE 4-22-52 STA. 7-360

05:30:10:02 TRUCK 1

REMARKS & NOTES		CAMERA			TIME	LENS	
PURPOSE	~FR./SEC.	NO.	SERIAL	MAG.	OPER.	FOC. LGH.	SERIAL
MJ7	500	E-17	1496		1-2-3+	152 mm	RC273
6		20	1525				313
5		21	1519				257
4		10	1515				358
3		26	1518				337
2		27	1514				253
YIELD	3000	7	1443		1st SEQ.	63	ET1229
		12	1512		2nd "		1207
		18	1517		3rd "		1253
COLOR	750	11	1521		1-2-3+	25	RY175
SURVEY	1/200 s	W-148	148			165	148
"	1/150 s	K-528				480	774528

[redacted]

EDGERTON, GERMESHAUSEN & GRIER, INC.

CAMERA DATA SHEET

TEST TS-3 DATE 4-22-52 STA. 7-360
09:30:10:02 TRUCK 1

PERF. CODE	EMULS.	FILTERS ND	FILTERS COLOR	APER. SET.	AIMING HORIZ.	AIMING VERT.	POWER	TIMING ON	TIMING OFF	MARKERS, SERIALS FM.	MARKERS, SERIALS VEL.	MARKERS, SERIALS ZERO	RACK POS.	CAM NO.
13278	BX	0	12	5.6	22°-15′L	LEVEL	120DC SHUNT	-2.55	SELF	23	200-4	4	A	E-17
77					19-10						10	10	B	20
76					16-00						9	9	C	21
75					12-48						4	4	D	10
74	MF			4	9-35						10	10	E	26
73				"	6-30						9	9	F	27
00				8	0-00	13°30′	40/20				4	4	G	7
01								-1.5			10	10	H	12
02								-0.5			9	9	I	18
13	ECN	2	0	5.6			SHUNT	-2.5			10	10	L	11
13235	MF	2	12	32	0°-00′	+6°18′	24 VDC	TSP	SELF	TSP 1	—	—	Apron	W-148
37	"	"	"	22	"	+4°00′	"	"	"	TSP 4	—	—	"	K-528

[redacted]

EDGERTON, GERMESHAUSEN & GRIER, INC.

CAMERA DATA SHEET

TEST TS-3 DATE 4-22-52 STA. 7-361

09:30:10:02 Truck 2 & Trailer 4

REMARKS & NOTES			CAMERA			TIME	LENS	
	PURPOSE	~FR./SEC.	NO.	SERIAL	MAG.	OPER.	FOC. LGH.	SERIAL
	YIELD	3000	E-8	1445		1ST SEQ.	63 mm	ET1254
	"	"	15	1494		"	"	RC606
	MJ 9	500	1	1525		1-2-3+	152	RC245
	YIELD	3000	16	1513		2ND SEQ.	63	ET1245
	"	"	9	1493		"		RC622
	MJ 8	500	2	1317		1-2-3+		RC549
	YIELD	3000	25	1520		3RD SEQ.		ET1223
	"	"	24	1522		"		RC539
	SHOCK	500	4	1321		1-2-3+	25	RY165
	COLOR	750	6	1318			"	RY137
ND 0,0.5,1.0,1.5,2,3,3.0	LIGHT (T)	30 1/s	GR-2	581			—	—
CHECK 15% FRBND. RAISE FRONT	ROCKETS	100	MH-4	745			35	LF6855
"	"		8	748			35	BF4052
	CLOUD		BH-5	1096			25	279097
	YIELD		R-8	8		20,130 μs	480	773944
	"		19	19		17,455		3961
	FIREBALL		26	26		9.8		4696
			31	31		30.1		3948
			9	9		99.8		4694
			33	33		403		3950
	SPECTR.		5	5		134		3956
	"		6	6		31675		3949

[redacted]

EDGERTON, GERMESHAUSEN & GRIER, INC.

CAMERA DATA SHEET

TEST TS-3 DATE 4-22-52 STA. 7-361

09:30:10.02 Truck 2 & Trailer 4

PERF. CODE	EMULS.	FILTERS ND	FILTERS COLOR	APER. SET.	AIMING HORIZ.	AIMING VERT.	POWER	TIMING ON	TIMING OFF	MARKERS, SERIALS FM.	MARKERS, SERIALS VEL.	MARKERS, SERIALS ZERO	RACK POS.	CAM NO.
13203	MF	0	12	4	0°-00'	11°57'	120DC 40/80	-2.5s	SELF	22	200-8	8	A	E-8
04	"	1		5.6	"	"	"				7	7	B	15
80	BX	0		"	28°-02L	LEVEL	SHUNT				12	12	C	1
05	MF	0		4	0-00	11-57	40/80	-1.5			8	8	D	16
06	"	1		5.6	"	"	"	"			7	7	E	9
79	BX	0		"	21-56L	LEVEL	SHUNT	-2.5			12	12	F	2
07	MF	0		4	0-00	11°-57'	40/80	-0.5			8	8	G	25
08		1		5.6		"	"	"			7	7	H	24
14		1		4		5°-54'	SHUNT	-2.5			12	12	I	4
15	ECN	2	0	8		11-57	"				8	8	L	6
27	S-XX	STEP #4	12	—		LEVEL	—				12	12	K	GR-2
13281	MF	1	12	8 30°	0°-00'	4°00'	120DC	-15s	-45s	—	100-1	—	O	MH-4
82	"	0	"	5.6 30°		LEVEL					6		N	8
19	ECN		0	4 120°		16-00					6		P	BH-5
53	TRI-X			11		11-57	115AC 24DC	-15m	+3s	24	—		R	R-8
54	"							-2.5s		"			S	10
45	HRHS									10			T	26
46	"									24			U	31
41	MF									"			V	9
42	"									10			W	33
49	ECP		86 CC10M										X	5
50	EKTA		CC40M										Y	6

EDGERTON, GERMESHAUSEN & GRIER, INC.

CAMERA DATA SHEET

TEST TS-3 DATE 4-22-52 STA. 7-362
09:30'10.02 TRAILER 5

REMARKS & NOTES			CAMERA			TIME	LENS	
	PURPOSE	~FR./SEC.	NO.	SERIAL	MAG.	OPER.	FOC. LGH.	SERIAL
RAISE FRONT	ROCKETS	100	MH-1	148			50	LF6996
" "	"		5	743			"	LF6935
	CLOUD		BH-2	1093			25	281674
	STEM		3	1095			152	BF2355
N.D. 0,0.5,1.0,1.5,2.0,3.0	LIGHT (T)	30 1/5	GR-5	667			—	—
" "	"	"	6	669			—	—
	YIELD		R-14	14		10,756 μs	480	773952
	"		24	24		7335		3958
	FIREBALL		4	4		16.9		3947
			19	19		47.2		2890
			18	18		4860		3955
			29	29		785		3954
	SPECTR.		12	12		215		3960
	"		17	17		79.8		3951
	SURVEY	1/200 S	W-147	147			165	147
	SURVEY	1/150 S	K-529	41-1194			480	774529

EDGERTON, GERMESHAUSEN & GRIER, INC.

CAMERA DATA SHEET

TEST TS-3 DATE 4-22-52 STA. 7-362
09:30:10 02 TRAILER 5

PERF. CODE	EMULS.	FILTERS ND	FILTERS COLOR	APER. SET.	AIMING HORIZ.	AIMING VERT.	POWER	TIMING ON	TIMING OFF	MARKERS, SERIALS FM.	MARKERS, SERIALS VEL.	MARKERS, SERIALS ZERO	RACK POS.	CAM NO.
13283	MF	1	12	8 30°	7°-57' L	4°-00	120VDC	-15s	+45s	—	100-5	—	P	MH-1
84	"	0	"	5.6 30°		"							PP	5
20	MF		0	2.3 150°		16-00							Q	BH-2
21	ECN		"	4 120°	0-00	3-00							QQ	3
28	S XX	STEP #10	47	—		LEVEL		-2.5s	+3s		200-2		IV	GR-5
29	IR	STEP #12	89B	—		"		"			"		O	6
55	TRI-X	0	0	11		13-55	115AC 24DC	-15m		16	—		R	R-14
47	HRHS							-25s					S	24
48	"												T	4
43	MF												U	19
44	TRI-X												V	18
56	HRHS									29			W	29
51	ECO		86 CC10M										X	12
52	"		"										Y	17
13236	MF	2	12	24	0-00	7° +6°18'	24VDC	TSP	SELF	TSP 3	—	—	Apron	W-147
38	"	"	"	22	"	+4°00	"	"	"	TSP 2	"	"	"	K-529

[redacted]

EDGERTON, GERMESHAUSEN & GRIER, INC.

CAMERA DATA SHEET

TEST TS-3 DATE 4-22-52 STAS. 7-248,
09:30:10:02 DUST & CLOUD

REMARKS & NOTES				CAMERA			TIME	LENS	
TM CALIBRATION	PURPOSE	~FR./SEC.		NO.	SERIAL	MAG.	OPER.	FOC. LGH.	SERIAL
TM 3 VEL.(CPS) 1.95	200	32		MAS-27				35mm	765260
5 1.95	"			22					764794
6 1.93	202			6					764805
7 1.95	"			19					765975
8 1.97	204			18					764810
9 1.97	"			28					762779
10 1.98	206			9					765257
11 1.98	"			24					764807
* AIM DOWN BLAST LINE	SHOCK & DUST	350	POLE	FIG-3					460392
	208	32		MAS-13					765008
				16					764793
			POLE	15					765249
	210			4					763965
				11					765377
*AIM DOWN BLAST LINE			POLE	17				75	764957
	201		TWR.	14				35	763387
	204		TWR.	26					763570
* AIM ~180° AWAY FROM 204 - SAGE BRUSH BLAST STA.	DUST		TWR.	1					763770
* AIM AT BLAST STATIONS EAST OF BLAST LINE	"	64	TWR	GSAP	30825			17	933468
AIM AT 207 DO NOT RAISE FRONT GUN		100	STA. 24-B	MH-7	742			400	52236
" 1/5 FR.L of 209			STA. 24-B	3	734				52237
" " " " 210			STA. 24-B	2	747				52238
BURSTS 1,2,3,5 min. -5 → +30 S CLOUD		24		ML-9	409			50 100	LF 6989 BF 9469
DID NOT RUN 1/200 S		VARIES		K17-9	AC44 190810			152	MF1629
1/225 SEC.		"		K17-7	AC44 190767			304	EE3019
BURSTS 1,2,3,5 min. -5 → +30 S CLOUD		24		ML-10	408			50 100	LF6969 BF9571
1/200 SEC.		VARIES		K17-10	AC44 191117			152	MF2545
1/225 SEC.		"		K17-8	AC44 190874			304	EC314

[redacted]

EDGERTON, GERMESHAUSEN & GRIER, INC. CAMERA DATA SHEET

TEST TS-3 DATE 4-22-5? STAs. 7-248, 08:30'10:02 DUST & CLOUD

PERF. CODE	EMULS.	FILTERS ND	FILTERS COLOR	APER. SET.	AIMING HORIZ.	AIMING VERT.	POWER	TIMING ON	TIMING OFF	MARKERS, SERIALS FM.	MARKERS, SERIALS VEL.	MARKERS, SERIALS ZERO	RACK POS.	CAM NO.
13285	MF	O	O	16	200	LEVEL	24DC	-5s	+16s	—	2-6	—	363	MAS-27
86				2.3	"						"		"	22
87				8	202						2-3		364	6
88				2.3	"						"		"	19
89				4	204						2-5		365	18
90				2.3	"						"		"	28
91				2.8	206						2-9		366	9
92				2.3	"		↓	↓			"		"	24
93				4.0	*		12DC	-3s			2-10		"	F16-3
94				2.8	208		24DC	-5s			2-7		367	MAS-13
67				2.3	"						"		"	16
96				2.3	"						"		"	15
97				2.8	210						2-11		368	4
98				2.3	"						"		"	11
99				2.8	*						"		"	17
95				11	201						2-8		375	14
68				4	204						2-5		376	26
69				5.6	*						"		"	1
66	↓	↓	↓	4	*	↓	↓	↓	↓	↓	—	↓	366	GSAP
13270	MF	O	O	8 45°	9°10' R	11°05'	115VAC	-15s	+45s	—	.00-S	—	7-248	MH-7
71				6.3 120°	14°00' R	11°12'								3
72	↓	↓	↓	5.6 170°	19°42' R	11°22'	↓	↓	↓	↓	↓	↓	↓	2
13222	ECN	O	O	8 90°	0°-00'	15% FGD.	115AC	-5s	BURSTS	—	—	—	358	ML-9
30	S-XX		25A	8		+30°	24-DC		30m		CLOCK			K17-9
31	"	↓	"	"	↓	+15°	"	↓	"	↓	"	↓	↓	K17-7
13223	ECN	O	O	8 90°	0°-00'	+3°	115AC	-5s	BURSTS	—	—	—	359	ML-10
33	S-XX		25A	8		30°	24-DC		30m		CLOCK			K17-10
32	"	↓	"	"	↓	15°	"	↓	"	↓	"	↓	↓	K17-8

[redacted]

EDGERTON, GERMESHAUSEN & GRIER, INC.

CAMERA DATA SHEET

TEST TS-4 DATE 5-1-52 STA. 7-360

09:29:58.6 TRUCK 1

REMARKS & NOTES		CAMERA			TIME	LENS	
PURPOSE	~FR./SEC.	NO.	SERIAL	MAG.	OPER.	FOC. LGH.	SERIAL
MJ 7	500	E-17	1496		1-2-3+	152 mm	RC273
6		20	1525				313
5		21	1519				257
4		10	1515				358
3		26	1518				334
2		27	1514				253
YIELD	3000	7	1443		1st SEQ.	63	ET1229
		12	1512		2nd "		1207
		18	1517		3rd "		1253
COLOR	750	11	1521		1-2-3+	25	RY175
SURVEY	1/200 SEC.	W-148	148			165	148
"	1/150 SEC.	K-528				480	774528

[redacted]

EDGERTON, GERMESHAUSEN & GRIER, INC. CAMERA DATA SHEET

TEST T5-4 DATE 5-1-52 STA. 7-360

09:29 68 6 TRUCK 1

PERF. CODE	EMULS.	FILTERS ND	FILTERS COLOR	APER. SET.	AIMING HORIZ.	AIMING VERT.	POWER	TIMING ON	TIMING OFF	MARKERS, SERIALS FM.	MARKERS, SERIALS VEL.	MARKERS, SERIALS ZERO	RACK POS.	CAM NO.
13378	BX	0	12	5.6	22° 15'L	LEVEL	120DC SHUNT	-2.55	SELF	23	200-4	4	A	E-17
77					19-10						10	10	B	20
76					16-00						9	9	C	21
75					12-48						4	4	D	10
74	MF			4	9-36						10	10	E	26
73				5.6	6-30						9	9	F	27
00				8	0-00	3°-37'	40/80				4	4	G	7
01								-1.5			10	10	H	12
02								-0.5			9	9	I	18
13	ECN	1	0	5.6		4-30	SHUNT	-2.5			4	4	L	11
13335	MF	2	12	32	0-00	LEVEL	24-DC	TSP	SELF	TSP 1	—	—	Apron	W-148
37	"	"	"	22	"	"	"	"	"	TSP 4	"	"	"	K-528

[redacted]

EDGERTON, GERMESHAUSEN & GRIER, INC.

CAMERA DATA SHEET

TEST TS-4 **DATE** 5-1-52 **STA.** 7-361

09:23:58.6 TRUCK 2 & TRAILER 4

REMARKS & NOTES	PURPOSE	~FR./SEC.	CAMERA NO.	CAMERA SERIAL	CAMERA MAG.	TIME OPER.	LENS FOC. LGH.	LENS SERIAL
	YIELD	3000	E-8	1445		1st SEQ.	63mm	ET1254
	"	"	15	1494		"	"	RC606
	MJB	500	1	1525		1-2-3+	152	RC245
	YIELD	3000	16	1513		2nd SEQ.	63	ET1245
	"	"	9	1493		"		RC622
	MJB	500	2	1317		1-2-3+		RC549
	YIELD	3000	25	1520		3rd SEQ.		ET1223
	"	"	24	1522		"		RC539
	STEM	500	4	1321		1-2-3+	25	RY165
AIM AT STA. 202	COLOR	750	6	1318			"	RY187
N.D. 0, 0.5, 1.0, 1.5, 2.3, 3.0	LIGHT (T)	30 1/sec	GR-2	581			—	—
RAISE FRONT	ROCKETS	100	MH-4	745			100	BF8525
	"		8	744			75	BS1764
	CLOUD		6	746			25	VF983
	YIELD		R-8	8		20,130 µs	480	773944
	"		10	10		17,455		3961
	FIREBALL		26	26		9.8		4696
			31	31		30.1		3948
			9	9		99.8		4694
			33	33		403		3950
	SPECTR.		5	5		26,550		3956
	"		6	6		155		3949

[redacted]

EDGERTON, GERMESHAUSEN & GRIER, INC.

CAMERA DATA SHEET

TEST TS-4 DATE 5-1-52 STA. 7-361

09:29:58.6 TRUCK 2 & TRAILER 4

PERF. CODE	EMULS.	FILTERS ND	FILTERS COLOR	APER. SET.	AIMING HORIZ.	AIMING VERT.	POWER	TIMING ON	TIMING OFF	MARKERS, SERIALS FM.	MARKERS, SERIALS VEL.	MARKERS, SERIALS ZERO	RACK POS.	CAM NO.
13303	MF	0	12	4	0°-00'	3°-30'	120DC 40/80	-2.5S	SELF	22	200-8	8	A	E-8
04	"	1		5.6	"	"	"				7	7	B	15
80	BX	0		"	28-02L	LEVEL	SHUNT				12	12	C	1
05	MF	0		4	0-00	3-30	40/80	-1.5			8	8	D	16
06	"	1		5.6	"	"	"	"			7	7	E	9
79	BX	0		"	21-56L	LEVEL	SHUNT	-2.5			12	12	F	2
07	MF	0		4	0-00	3-30	40/80	-0.5			8	8	G	25
08	"	1		5.6		"	"	"			7	7	H	24
14	"	1		4		5-10	SHUNT	-2.5			12	12	I	4
15	ECN	0	0	5.6	4°41'L	"	"				8	8	L	6
27	SXX	STEP #4	12	—	0°-00	LEVEL	—		+3S		12	12	K	GR-2
13381	MF	1	12	5.6 60°	0°-00	LEVEL	120 DC	-15S	+45S	—	100-1	—	O	MH-4
82	"	0	"	5.6 90°		"					6		N	8
19	ECN		0	4 120°		16°					6		P	6
53	TRI-X			11		3°-30'	115AC 24DC	-15m	+3S	24	—		R	R-8
54	"							-2.5S		"			S	10
45	HRHS									10			T	26
46	"									24			U	31
41	MF									"			V	9
42	"									10			W	33
43	EKTA		CC40M										X	5
50	ECP		86 CC10M										Y	6

[redacted]

EDGERTON, GERMESHAUSEN & GRIER, INC.

CAMERA DATA SHEET

TEST TS-4 DATE 5-1-52 STA. 7-362

09:29:58.6 TRAILER 5

REMARKS & NOTES			CAMERA			TIME	LENS	
RAISE FRONT	PURPOSE	~FR./SEC.	NO.	SERIAL	MAG.	OPER.	FOC. LGH.	SERIAL
" "	ROCKETS	100	MH-1	748			75mm	BS1984
	"		5	743			50	LF6935
	CLOUD		BH-2	1093			25	291674
	STEM		5	1096			152	3F2355
N.D. 0,0.5,1.0,1.5,2.0,3.0	LIGHT (T)	30'/s	GR-5	667			—	—
" "		"	6	669			—	—
	YIELD		R-14	14		10,756μs	480	773952
	"		24	24		7335		3958
	FIREBALL		4	4		16.9		3947
			19	19		49.2		2890
			18	18		4860		3955
			29	29		785		3954
	SPECTR.		12	12		215		3960
	"		17	17		79.8		3951
	SURVEY	1/200 s	W-147	147		—	165	147
	"	1/150 s	K-529	41-1194		—	480	774529

[redacted]

EDGERTON, GERMESHAUSEN & GRIER, INC.

CAMERA DATA SHEET

TEST TS-4 DATE 5-1-52 STA. 7-362
09:29:58.6 TRAILER 5

PERF.	EMULS.	FILTERS		APER.	AIMING		POWER	TIMING		MARKERS, SERIALS			RACK	CAM
CODE		ND	COLOR	SET.	HORIZ.	VERT.		ON	OFF	FM.	VEL.	ZERO	POS.	NO.
13383	MF	1	12	56 60°	7°57'L	LEVEL	120 DC	-15s	+45s	—	100-5	—	P	MH-1
84	"	0	"	56 90°		"							PP	5
20	ECN		0	4 120°		16°							Q	BH-2
21	"		"	11 15°	0°-00'	3°							QQ	5
28	S-XX	STEP #19	47	—		LEVEL		-25s	+3s		200-2		N	GR-5
22	IR	STEP #21	89B	—		"		"	"		"		O	6
13355	TRI-X	0	0	11	0°-00'	4°-47'	115AC 24DC	-15m	+3s	16	—	—	R	R-14
47	HRHS							-25s					S	24
48	"												T	4
43	MF												U	19
44	TRI-X												V	18
56	HRHS									29			W	29
51	ECP		86 CC10M										X	12
52	"		"										Y	17
13336	MF	2	12	24	0°-00	LEVEL	24 DC	TSP	SELF	TSP 3	—	—	Apron	W-147
38	"	"	"	22	"	"	"	"	"	TSP 2	—	—	"	K-529

[redacted]

EDGERTON, GERMESHAUSEN & GRIER, INC.

CAMERA DATA SHEET

TEST TS-4 DATE 5-1-52 STAS. 7-248,
09:29:58.6 DUST & CLOUD

REMARKS & NOTES				CAMERA			TIME	LENS	
	PURPOSE	~FR./SEC.		NO.	SERIAL	MAG.	OPER.	FOC. LGH.	SERIAL
DO NOT RAISE FRONT	GUNS	100	STA. 248	MH-7	742			400 mm	52236
				3	734				52237
				2	747				52238
VEL. MARK* VEL. (CPS)	DUST	35		MAS-21		27-1		35	765260
3 1.95				22		22-1			764794
5 1.95				6		7-2			764805
6 1.93				19		19-1			763975
7 1.95				18		18-1			764810
8 1.97				28		28-2			762779
9 1.97				9		9-1			765257
10 1.98				24		24-2			764807
11 1.98			POLE	8		8-1			764796
				13		13-1			765008
				16		16-1			764793
			POLE	15		15-1			765249
				4		4-1			763965
				11		11-1			765377
LOOKS DOWN BLAST LINE			POLE	17		17-1		75	764357
	DUST	35	TOWER	MAS-14		14-1		35	763387
	DUST & SHOCK	350		F16-3					460392
	DUST	35		MAS-26		26-2			763970
LOOKS AWAY FROM BLAST LINE AT SAGEBRUSH *				1		1-2			763770
LOOKS DOWN BLAST LINE				2		2-1			764015
	DUST & SHOCK	700		F8-3					460406
	CLOUD	VARIES		K17-9	AC44 190810			152	MF1629
		"		7	AC44 190767			304	EE3019
−5 → +30s 10 SEC. BURSTS AT 1,2,3,4,5, etc. min.		24		ML-9	409			50 100	LF6989 BF9469
	CLOUD	VARIES		K17-10	AC44 191117			152	MF2545
	"	"		8	AC44 190874			304	EC314
40 MIN. BEAM-SPLITTING PRISM	CLOUD			F16-11	16C-15			254	876314

[redacted]

EDGERTON, GERMESHAUSEN & GRIER, INC.

CAMERA DATA SHEET

TEST TS-4 DATE 5-1-52 STAs. 7-248, 08:29:58 6 DUST & CLOUD

PERF. CODE	EMULS.	FILTERS ND	FILTERS COLOR	APER. SET	AIMING HORIZ.	AIMING VERT.	POWER	TIMING ON	TIMING OFF	MARKERS, SERIALS FM.	MARKERS, SERIALS VEL.	MARKERS, SERIALS ZERO	RACK POS.	CAM NO.
13370	MF	0	0	8 45°	7°02'R	+4°00'	115AC	-15S	+45S	—	100-4	—	7-248	MH-7
71				56 120°	12-08R	+3°-55'								3
72				56 170°	17-05R	+3°50'								2
13385	MF	2	0	2.3	200	LEVEL	24DC	-5S	+16S	—	2-6	—	363	MAS-27
86		0		"	"						"		"	22
87				22	202						2-3		364	6
88				2.3	"						"		"	19
89				8	204						2-5		365	18
90				2.3	"						"		"	28
91				4	206						2-9		366	9
92				2.3	"						"		"	24
93				2.8	"						"		"	8
94				"	208						2-7		367	13
95				2.3	"						"		"	16
96				2.8	"						"		"	15
97				"	210						2-11		368	4
98				2.3	"						"		"	11
99				2.8	ZERO						"		"	17
13364	MF	0	0	2.3	201	LEVEL	24DC	-5S	+16S	—	2-8	—	375	MAS-14
65		1		22	"	-5°00'	12DC	-3S			2-10		"	F16-3
66		0		8	204	LEVEL	24DC	-5S			2-5		376	MAS-26
67				8	*									1
68				11	202									2
69				2	204	-12° [illegible]	12DC	-3S			—			F8-3
13331	S-XX	0	25A	8	0°-00'	+30°	24DC	-5S	30m	—	CLOCK	—	358	K17-9
30	"		"	"		+15°	"		"		"			7
22	MF		12	2.3 120°		+4°00	115AC		BURSTS		—			ML-9
13333	S-XX	0	25A	8	0°-00'	+30°	24DC	-5S	30m	—	CLOCK	—	359	K17-10
32	"	0	"	"	"	+15°	"	"	"	"	"	"	"	8
09	MF	0	47/29	5.6	0°-00'		60VDC	~-2S		—	200-1	—	CP	F16-11

[redacted]

EDGERTON, GERMESHAUSEN & GRIER, INC.

CAMERA DATA SHEET

TEST TS-5 DATE 5-7-52 STA. 1-355
TRUCK 1 & TRAILER 4

REMARKS & NOTES				CAMERA			TIME	LENS	
P_S w/m²		PURPOSE	~FR./SEC.	NO.	SERIAL	MAG.	OPER.	FOC. LGH.	SERIAL
2×10^5	5-7s OPERATION	BREAKAWAY	650	E-17	1496			152mm	RC273
5×10^5	"	"	"	20	1525			"	RC313
1.5×10^5		YIELD	5000	12	1512			102	RY510
4×10^4				18	1517			"	ET415
1.5×10^5				7	1443			63	ET1229
4×10^4				24	1522			"	RC539
2×10^5	5-7s OPERATION	STEM	650	27	1514			25	RY189
3×10^4	8-10s OPERATION	COLOR	400	1	1454			"	RY183
	N.D. 0, 0.5, 1.0, 1.5, 2.0, 3.0	LIGHT	50/s	GR-4	670			—	—
2×10^3	RAISE FRONT	BW SHOCK	100	MH-4	745			100	BF8525
10^3	" "	COLOR		8	744			"	BF9463
100	TILT ~16°	CLOUD		6	746			25	VF983
		YIELD		R-8	8		4940μs	480	773947
		"		10	10		8300		3961
		FIREBALL		26	26		9.8		4696
				31	31		27.5		3948
				9	9		95		4694
				33	33		403		3950
		COLOR		5	5		16,800		3956
		"		6	6		152		3949

[redacted]

EDGERTON, GERMESHAUSEN & GRIER, INC.

CAMERA DATA SHEET

TEST TS-5 DATE 5-7-52 STA. 1-35J
Truck 1 & Trailer 4

PERF. CODE	EMULS.	FILTERS ND	FILTERS COLOR	APER. SET.	AIMING HORIZ.	AIMING VERT.	POWER	TIMING ON	TIMING OFF	MARKERS, SERIALS FM.	MARKERS, SERIALS VEL.	MARKERS, SERIALS ZERO	RACK POS.	CAM NO.
13474	MF	1	12	5.6	1°42'L	+2°-20'	120DC SHUNT	-1.5S	SELF	23	200-4	4	A	E-17
75		"		8	3°-24'L		"				10	10	B	20
00		0		"	0°-00'		40/80				9	9	C	12
01				4							4	4	D	18
02				8							10	10	E	7
03				4							9	9	F	24
73		1		5.6		+5°-00	SHUNT				4	4	G	27
13	ECN	1	0	8		"	"				4	4	L	1
26	S-XX	STEP #20	61	—		LEVEL					9	—	K	GR-4
13481	MF	0	12	4 60°	0°-00'	LEVEL	120DC	-15S	+20S	—	100-1	—	O	MH-4
19	ECN		0	4 15°		"					6		N	8
20	"			4 170°		16°-00'					6		P	6
53	TRI-X			11		+2°-20'	115AC 24DC	-15m	+1S	24	—		R	R-8
54	"							-1.0S		"			S	10
45	HRHS									10			T	26
46	"									24			U	31
41	MF									"			V	9
42	"									10			W	33
49	EKTA		CC40M										X	5
50	ECP		86 CC10M										Y	6

EDGERTON, GERMESHAUSEN & GRIER, INC.

CAMERA DATA SHEET

TEST TS-5 DATE 5-7-52 STA. 1-356

TRUCK 2 & TRAILER 5

REMARKS & NOTES			CAMERA			TIME	LENS	
P_s W/m²	PURPOSE	~FR./SEC.	NO.	SERIAL	MAG.	OPER.	FOC. LGH.	SERIAL
1.5×10^6	YIELD	3000	E-25	1520			102	ET201
4×10^4			15	1494			"	RC185
1.5×10^5			9	1493			63	RC622
10^8	FIREBALL	8000	F8-3	8C-12			254	876314
10^7	"	"	F8-14	8C-6			"	876312
4×10^4	YIELD	3000	E-16	1518			63	ET1245
10^6	FIREBALL	4000	F16-11	16C-15			100	617368
10^6	"	"	F16-R	16-168			"	617367
2×10^6	YIELD	3000	E-8	1445			63	ET1254
ND 0,0.5,1.0,1.5,2.3,3.0	LIGHT	50 1/sec.	GR-2	581			—	—
5×10^3	RAISE FRONT SHOCK	100	MH-1	748			100	BF9465
10^3	" "		5	743				BF8507
200			BH-2	1093				282354
N.D. 0,0.5,1.0,1.5,2.0,3.0	LIGHT	50 1/sec	GR-5	667			—	—
" "	"	"	GR-6	669			—	—
			R-14	14		10,300 μs	480	773952
			24	24		7335		3958
			4	4		4400		3947
			19	19		49.2		2890
			18	18		210		3955
			29	29		785		3954
			12	12		40.2		3960
			17	17		82.5		3951

[redacted]

EDGERTON, GERMESHAUSEN & GRIER, INC. CAMERA DATA SHEET

TEST TS-5 DATE 5-7-52 STA. 1-356

Truck 2 & Trailer 5

PERF. CODE	EMULS.	FILTERS ND	FILTERS COLOR	APER. SET.	AIMING HORIZ.	AIMING VERT.	POWER	TIMING ON	TIMING OFF	MARKERS, SERIALS FM.	MARKERS, SERIALS VEL.	MARKERS, SERIALS ZERO	RACK POS.	CAM NO.
13404	MF	0	12	8	0°-00′	1°50′	120DC 40/80	-1.5s	SELF	22	200-8	8	A	E-25
05				4							7	7	B	15
06				8							12	12	C	9
08		3		5.6				-1.0s	+1s		8	8	D	F8-3
09		2		4				"	"		7	7	E	F8-14
07		0		"			40/80	-1.5s	SELF		12	12	F	E-16
10		1		5.6				-1.0s	+1s		8	8	G	F16-11
11		1						"	"	—	—	—	H	F16-R
14	ECN	2	0				40/80	-1.5s	SELF	22	12	12	I	E8
27	BX	STEP #4	12	—		LEVEL		"	"	—	12	—	K	GR-2
13482	MF	0	12	5.6 30°	0°-00′	LEVEL	120DC	-15s	+20s	—	100-5	—	P	MH-1
83				5.6 170°	"	"							PP	5
84				2.3 170°	5°22′L	$+3^{\circ}00$							Q	BH-2
28	S-XX	STEP #19	47	—	0°-00′	LEVEL		-1.0s	SELF		200-2		N	GR-5
29	IR	STEP #21	89B	—	"	"		"	"		"		O	6
13455	TRI-X	0	0	11	0°-00′	1°50′	115AC 24DC	-15m	+1s	16	—	—	R	R-14
47								-1.0s					S	24
48													T	4
43	MF												U	19
44	"												V	18
56	HRHS									29			W	29
51	ECP		B6 CC10M										X	12
52	"		"										Y	17

EDGERTON, GERMESHAUSEN & GRIER, INC.

CAMERA DATA SHEET

TEST TS-5 DATE 5-7-52 STA. 4-248

REMARKS & NOTES		CAMERA			TIME	LENS	
PURPOSE	~ FR./SEC.	NO.	SERIAL	MAG.	OPER.	FOC. LGH.	SERIAL
GUNBURST 1+2		MH-7	742			400	52236
3		3	734				52237
4		2	747				52238
		E-23	CP				

[redacted]

EDGERTON, GERMESHAUSEN & GRIER, INC.

CAMERA DATA SHEET

TEST TS-5 DATE 5-7-52 STA. 4-248

PERF. CODE	EMULS.	FILTERS ND	FILTERS COLOR	APER. SET.	AIMING HORIZ.	AIMING VERT.	POWER	TIMING ON	TIMING OFF	MARKERS, SERIALS FM.	MARKERS, SERIALS VEL.	MARKERS, SERIALS ZERO	RACK POS.	CAM NO.
13470	MF	1	O	6.3 15°	3°-03'R	3°55'	115AC	-15s	+20s	—	100-4	—	A	WH-7
71	"	O	↓	6.3 170°	5°-00'R	5°-49'	↓	↓	↓	↓	↓	↓	B	3
72	BX	"	↓	6.3 170°	7°-07'R	7°-53'	↓	↓	↓	↓	↓	↓	C	2
13412	MF													E-23

[redacted]

EDGERTON, GERMESHAUSEN & GR'ER, INC.

CAMERA DATA SHEET

TEST TS-6 DATE 5-25-52 STA. 4-355

TRUCK 2 & TRAILER 5

REMARKS & NOTES			CAMERA			TIME	LENS	
	PURPOSE	~FR./SEC.	NO.	SERIAL	MAG.	OPER.	FOC. LGH.	SERIAL
	CORE	3000	E-25	1520			102	ET201
	YIELD		15	1494			"	RC185
	"		9	1493			63	RC622
	FIREBALL	8000	F8-3	8C-12			254	876314
	YIELD	3000	E-16	1513			63	ET1245
	FIREBALL	4000	F16-11	16C-15			100	617363
	"	"	F16-R	16-168			"	617367
	COLOR	3000	E-8	1445			63	ET1254
N.D. 0, 0.5, 1.0, 1.5, 2.0, 3.0	LIGHT	50 1/sec.	GR-2	581			—	—
5 µs RAP SHUTTER WITH NEWTONIAN MIRROR			TR-A	3427		0	1829	NEWTONIAN
	150 µs MECH. SHUTTER		KODAK 35	EDG·MIT			152	DOUBLET
RAISE FRONT	SHOCK	100	MH-1	748			100	BF9465
" "			5	743				BF8507
			8H-2	1093				282354
N.D. 0, .5, 1, 1.5, 2, 3 BAIRD #281775A' #7-2016	LIGHT	50 1/sec	GR-2	667			—	—
" "	"	"	6	669			—	—
	YIELD		R-14	14		10,900 µs	480	773952
	"		24	24		7335		3958
			4	4		4400		3947
			19	19		49.2		2890
			18	18		210		3955
			29	29		785		3954
3 µs FM TELLER LIGHT			12	12		0		3960
5 X-UNIT PULSE DELAYED 95 µs (TT = 98.1)			17	17				3951
5 " " " " "			5	5				3956
3 FM TELLER LIGHT			6	6				3949
1 FM TELLER-SPECIAL			TR-B	3149-B		~ 0	4064.	CASSEGRAIN

[redacted]

EDGERTON, GERMESHAUSEN & GRIER, INC.

CAMERA DATA SHEET

TEST TS-6 DATE 5-25-52 STA. 4-355
TRUCK 2 & TRAILER 5

PERF. CODE	EMULS.	FILTERS NO	FILTERS COLOR	APER. SET.	AIMING HORIZ.	AIMING VERT.	POWER	TIMING ON	TIMING OFF	MARKERS, SERIALS FM.	MARKERS, SERIALS VEL.	MARKERS, SERIALS ZERO	RACK POS.	CAM NO.
13604	MF	2	12	5.6	0°-00'	+2°-25'	120DC 40/80	-1.5S	SELF	22	200-8	8	A	E-25
05		0		8							7	7	B	15
06		0									12	12	C	9
08		2						-1.0S	+1S		8	8	D	F8-3
07		1		5.6			40/80	-1.5S	SELF		12	12	F	E-16
10		1						-1.0S	+1S		8	8	G	FIG-11
11		1						"	"	—	—	—	H	FIG-R
14	ECN	2	—				40/80	-1.5S	SELF	22	12	12	I	E-B
27	BX	STEP #23	12	—		LEVEL		-1.0S	"	—	12	12	K	GR-2
50	LIN-PAN	0	0	10		2°25'	115AC 24DC	-15m; -1S	+1S	22	—	—	J	TR-A
13651	ECN	0	0	50	0°-00'	+2°-26'		88+5ms	SELF	TSP 4	—	—	P+	KODAK 35
82	MF		12	2 3 170°		+4°-30'	120DC	-15S	+20S	—	100-5		Y	MH-1
83				4 60°									PP	5
84				8 45°	5°-22'L								Q	BH-2
28	S-XX	STEP #19	47+INT	--	0°-00'	LEVEL		-1.0S	SELF		200-2		N	GR-5
29	IR	STEP #21	89B	—		"		"	"		"		O	6
55	TRI-X	0	0	11		+2°-25'	115AC 24DC	-15m; -1S	+1S	16	—		R	R-14
— 47													S	24
48													T	4
43	MF												U	19
44	"												V	18
— 56	HRHS												W	29
59	TRI-X				MIRROR					29			APRON	12
60										TV				17
57										"				5
58										29				6
49	BX			20	0°-00					5			QQ	TR-B

FILM SWITCHED IN LOADING

EDGERTON, GERMESHAUSEN & GRIER, INC.

CAMERA DATA SHEET

TEST TS-6 DATE 5-25-52 STA. 4-356
Truck 1 & Trailer 4

REMARKS & NOTES			CAMERA			TIME	LENS	
	PURPOSE	~FR./SEC.	NO.	SERIAL	MAG.	OPER.	FOC. LGH.	SERIAL
	SHOCK	650	E-17	1496			152	RC273
	"	"	20	1525			"	RC313
	YIELD	3000	12	1512			102	RY510
			18	1517			"	ET415
			7	1443			63	ET1229
			24	1522			"	RC539
	STEM	650	27	1514			25	RY189
	COLOR	400	1	1454			"	RY188
N.D. 0, 0.5, 1.0, 1.5, 2.0, 3.0	LIGHT	50/s	GR-4	670			—	—
Wr. 25 + BAIRD #7-2079-B 6490±125A°								
RAISE FRONT	SHOCK	100	MH-4	745			100	BF8525
10^4 " "	CLOUD		8	744			"	BF9463
200	"		6	746			25	VF983
			R-8	8		4940	480	773944
			10	10		8300		3961
			26	26		9.8		4696
			31	31		27.5		3948
			9	9		95		4694
			33	33		403		3950
VIEWS TOWER AREA 2			MH-3	734		—	400	52237
W47 ON LEFT		3000	FB-14	BC-6			254	876312
			CINE-THEOD.	66			305	—

[redacted]

EDGERTON, GERMESHAUSEN & GRIER, INC.

CAMERA DATA SHEET

TEST TS-6 DATE 5-25-52 STA. 4-356

TRUCK 1 & TRAILER 4

PERF. CODE	EMULS.	FILTERS ND	FILTERS COLOR	APER. SET.	AIMING HORIZ.	AIMING VERT.	POWER	TIMING ON	TIMING OFF	MARKERS, SERIALS M.	MARKERS, SERIALS VEL.	MARKERS, SERIALS ZERO	RACK POS.	CAM NO.
13674	MF	1	12	5.6	1°-42'L	+1°47'	120DC SHUNT	-1.5s	SELF	23	200-4	4	A	E-17
75		0	47	"	3°-24'L		"				10	10	B	20
00			12	4	0°-00		40/80				9	9	C	12
01				8							4	4	D	18
02				"							10	10	E	7
03		1		5.6							9	9	F	24
73				"		+4°00'	SHUNT				4	4	G	27
13	ECN		0	8		"	"				4	4	L	1
26	UN-PAN	STEP #28	25+INT	—		LEVEL		-1.0s		—	9	—	K	GR-4
13681	MF	0	12	2.8 170°	0°-00'	3°-30'	120DC	-15s	+30s	—	100-1	—	O	MH-4
19	ECN	1	0	4 15°		"					1		N	8
20	"	0		4 170°		16°-00'					6		P	6
53	TRI-X			11		+1°47'	115AC 24DC	-15m, -1s	+1s	10	—		R	R-8
54	"									24			S	10
45	HRHS									10			T	26
46	"									24			U	31
41	MF									"			V	9
42	"									10			W	33
85	S-XX			5 170°	TOWER 2		120 DC	-15s	+30	—	100-6		EXT.	MH-3
13609	ECN	2	29/47	11	CAB	+0°-21' CAB	60 AC	-2s	+3s	—	200-1	—	CP	FB-14
23	UN-PAN	0	—	5	TRACKING		115AC 12DC	0	7'15"	—	—	—	"	CINE-THEOD

[redacted]

EDGERTON, GERMESHAUSEN & GRIER, INC.

CAMERA DATA SHEET

TEST TS-7 DATE 6-1-52 STA. 3-355

TRUCK 1 & TRAILER 4

REMARKS & NOTES			CAMERA			TIME	LENS	
	PURPOSE	~FR./SEC.	NO.	SERIAL	MAG.	OPER.	FOC. LGH.	SERIAL
	SHOCK	650	E-17	1496			152	RC273
	"	"	20	1525			"	RC313
	YIELD	3000	12	1512			102	RY510
			18	1517			"	ET415
			7	1443			63	ET1229
			34	1522			"	RC539
	STEM	650	27	1514			25	RY189
	COLOR	400	1	1454			"	RY183
ND 0, 0.5, 1.0, 1.5, 2.0, 3.0	LIGHT	80 1/SEC.	GR-4	670			—	—
W25 + BAIRD INT #7-20798 6490 ± 125 Å								
RAISE FRONT	SHOCK	100	MH-1	748			100	BF9465
	"		4	745				BF8525
	CLOUD		8	744				BF9463
	"		6	746			25	VF983
			R-8	8		13,650 μs	480	773944
			10	10		8300		3961
			26	26		9.8		4686
			31	31		27.5		3948
			9	9		95		4694
			33	33		403		3950
W47 ON LEFT			F8-14	BC-6		—	254	876312
			CINE-THEOD	66		—	305	—

EDGERTON, GERMESHAUSEN & GRIER, INC.

CAMERA DATA SHEET

TEST TS-7 DATE 6-1-52 STA. 3-355
TRUCK 1 & TRAILER 4

PERF. CODE	EMULS.	FILTERS ND	FILTERS COLOR	APER. SET.	AIMING HORIZ.	AIMING VERT.	POWER	TIMING ON	TIMING OFF	MARKERS, SERIALS FM.	MARKERS, SERIALS VEL.	MARKERS, SERIALS ZERO	RACK POS.	CAM NO.
13774	MF	1	12	8	1°42'L	1°45'	120DC SHUNT	-1.5s	SELF	23	200-4	4	A	E-17
75		0.5	47		3°24'L		"				10	10	B	20
00		0	12		0°-00'		40/80				9	9	C	12
01		1		5.6							4	4	D	18
02		0		8							10	10	E	7
03		1		5.6							9	9	F	24
73				"		4°00'	SHUNT				4	4	G	27
13	ECN		0	8		"	"				4	4	L	1
26	LIN-PAN	STEP #28	25+INT	—		LEVEL		-1.0s		—	9	—	K	GR-4
13782	MF	0	12	56 60°	0°-00'	2°30'	120DC	-15s	+30s	—	100-6	—	PP	MH-1
81	"	0	"	8 45°	5°-22'L						1		O	4
19	ECN	1	O	4 15°	0°-00'						1		N	8
20	"	0		4 170°		+12°00'					6		P	6
63	TRI-X			11		1°45'	115AC 24DC	-15m, -1s	+1s	10	—		R	R-8
54	"									24			S	10
45	HRHS									10			T	26
46	"									24			U	31
41	MF									"			V	9
42	"									10			W	33
13709	ECN	2	29/47	29/47	CAB	+0°17'	60AC	-2s	+3s	—	200-1	—	CP	F8-14
23	LIN-PAN	0	—	—	TRACKING		115AC 12DC	0		—	—	—	"	CINE-THEOD

[redacted]

EDGERTON, GERMESHAUSEN & GRIER, INC. CAMERA DATA SHEET 7-248,

TEST TS-7 DATE 6-1-52 STAs 3-356

Truck 2 & Trailer 5

REMARKS & NOTES			CAMERA			TIME	LENS	
	PURPOSE	~FR. SEC.	NO.	SERIAL	MAG.	OPER.	FOC. LGH.	SERIAL
	CORE	3000	E-25	1520			102	ET201
	YIELD		15	1494			"	RC185
	"		9	1493			63	RC622
	FIREBALL	9000	FB-3	8C-12			254	576314
	YIELD	3000	E-16	1513			63	ET1245
	FIREBALL	4000	F16-11	16C-15			100	617363
	"	"	F16-R	16-168			"	617367
	COLOR	3000	E-8	1445			63	ET1254
ND 0,0.5,1.0,1.5,2.0,3.0	LIGHT	80 1/SEC	GR-2	581			—	—
3 µs RAP SHUTTER	TELLERLIGHT		TR-A	3427		0	1829	NEWTONIAN
RAISE FRONT	SHOCK	100	MH-5	743			75	BS1805
	"	"	BH-2	1093			100	282354
ND 0,0.5,1.0,1.5,2.0,3.0	BAIRD 7-2016 4381±75A° LIGHT	80 1/SEC	GR-5	667			—	—
" "	"	"	6	669			—	—
			R-14	14		10,900 µs	480	773952
			24	24		7335		3958
			4	4		4400		3947
			19	19		49.2		2890
			18	18		210		3955
			29	29		785		3954
	1 µs SPECIAL FM.		TR-B	3149 B		~0	4064	CASSEGRAIN
3 µs	FM TELLER LIGHT		R-12	12		0	480	773960
5	X UNIT PULSE DELAYED 95 µs (TT 97.6 µs)		17	17				3951
5	" " " " " " "		5	5				3956
3	FM TELLER LIGHT		6	6				3949

[redacted]

EDGERTON, GERMESHAUSEN & GRIER, INC. CAMERA DATA SHEET 7-248

TEST TS-7 DATE 6-1-52 STAS. 3-356 Truck 2 & Trailers

PERF. CODE	EMULS.	FILTERS ND	FILTERS COLOR	APER. SET.	AIMING HORIZ.	AIMING VERT.	POWER	TIMING ON	TIMING OFF	MARKERS, SERIALS FM.	MARKERS, SERIALS VEL.	MARKERS, SERIALS ZERO	RACK POS.	CAM NO.
13704	MF	2	12	5.6	0°-00'	+0°33'	120DC 40/80	-1.5S	SELF	22	200-8	8	A	E-25
05		0		8							7	7	B	15
06		0									12	12	C	9
08		2						-1.0S	+1S		8	8	D	F8-3
07		1		5.6			40/80	-1.5S	SELF		12	12	F	E-16
10								-1.0S	+1S		8	8	G	F16-11
11								"	"	—	—	—	H	F16-R
14	ECN	2	—				40/80	-1.5S	SELF	22	12	12	I	E-8
27	BX	STEP #23	12	—		LEVEL		-1.0S	"	—	12	—	K	GR-2
50	LIN-PAN	0	0	10		+0°33'	115AC 24DC	-15m;-1½	+1S	22	—	—	J	TR-A
13783	MF	0	12	2.3 170°	0°-00'	+2°30'	120DC	-15S	+20S	—	100-5	—	PP	MH-5
84	"	0	"	2.3 120°		"		"	"		5		Q	BH-2
28	S-XX	STEP #19	47+INT	—		LEVEL		-1.0S	SELF		200-2		N	GR-5
29	IR	STEP #25	89B	—		"		"	"		2		O	6
55	TRI-X	0	0	11		+0°33'	115AC 24DC	-15m;-1S	+1S	16	—		R	R-14
47													S	24
48													T	4
43	MF												U	19
44	"												V	18
56	HRHS												W	29
49	BX			20						5			QQ	TR-B
13759	TRI-X	0	0	11	MIRROR	1°54'	115AC 24DC	-15m;-1S	+1S	29	—	—	7-248	R-12
60										TV				17
57										"				5
58										29				6

[redacted]

EDGERTON, GERMESHAUSEN & GRIER, INC.

CAMERA DATA SHEET

TEST TS-8 DATE 9-5-52 STA. 2-355
TRUCK 2 TRAILER 5

REMARKS & NOTES	PURPOSE	~FR./SEC.	CAMERA NO.	CAMERA SERIAL	CAMERA MAG.	TIME OPER.	LENS FOC. LGH.	LENS SERIAL
	CORE	3000	E-25	1520			102	ET201
	YIELD		15	1494			"	RC185
	"		9	1493			63	RC622
	FIREBALL	9000	F8-3	8C-12			254	876314
	YIELD	3000	E-16	1513			63	ET1245
	FIREBALL	4000	F16-11	16C-15			100	617363
	"	"	F16-R	16-168			"	617367
	COLOR	3000	E-8	1445			63	ET1254
ND 0,0.5,1.0,1.5,2.0,3.0	LIGHT	80/SEC	GR-2	581			—	—
5 µs RAP SHUTTER	TELLER LIGHT		TR-A	3427		0	1829	NEWTONIAN
RAISE FRONT	SHOCK	100	MH-5	743			75	851805
	"	"	BH-2	1093			100	282354
ND 0,.5,1,1.5,2,3 BAIRD #7-2016 4481±75Å	LIGHT	80/SEC.	GR-5	667			—	—
"	"	"	6	669			—	—
	YIELD		R-14	14		10,900 µs	480	773952
			24	24		7335		3958
			4	4		4400		3947
			19	19		49.2		2890
			18	18		210		3955
			29	29		785		3954
1 µs SPECIAL F.M. - "NO DELAY"			TR-B	3149-B		0	4060	CASSEGRAIN
3 µs FM	TELLER LIGHT		R-12	12		0	480	773960
5	EARLY BOMB		17	17		5.5		3951
5	COLOR		5	5		3160		3956
5 FM	TELLER LIGHT		6	6		0		3949

[redacted]

EDGERTON, GERMESHAUSEN & GRIER, INC.

CAMERA DATA SHEET

TEST TS-8 DATE 6-5-52 STA. 2-355
TRUCK 2 & TRAILER 5

PERF. CODE	EMULS.	FILTERS ND	FILTERS COLOR	APER. SET.	AIMING HORIZ.	AIMING VERT.	POWER	TIMING ON	TIMING OFF	MARKERS, SERIALS FM.	MARKERS, SERIALS VEL.	MARKERS, SERIALS ZERO	RACK POS.	CAM NO.
13804	MF	2	12	5.6	0°-00'	2°50'	120DC 40/80	-1.5S	SELF	22	200-8	8	A	E-25
05		0		8							7	7	B	15
06		"					↓	↓	↓		12	12	C	9
08		2		↓				-1.0S	+1S		8	8	D	FB-3
07		1		5.6			40/80	-1.5S	SELF		12	12	F	E-16
10								-1.0S	+1S	↓	8	8	G	F16-11
11	↓	↓	↓					"	"	—	—	—	H	F16-R
14	ECN	2	—	↓		↓	40/80	-1.5S	SELF	22	12	12	I	E-8
27	BX	STEP #25	12	—		LEVEL	↓	-1.0S	"	—	12	12	K	GR-2
50	LIN-PAN	0	0	10	↓	2° 50'	115AC 24DC	-15m,-1.5S	+1S	22	—	—	J	TR-A
13883	MF	0	12	2.3 170°	0°-00'	3°-45'	120DC	-15S	+20S	—	100-5	—	PP	MH-5
84	"	"	"	2.5 120°		4° 30'		"	"		"		Q	BH-2
28	S-XX	STEP #19	47+INT	—		LEVEL		-1.0S	SELF		200-2		N	GR-5
29	IR	STEP #14	89B	—		"	↓	"	"	↓	"		O	6
55	TRI-X	0	0	11		2°50'	115AC 24DC	-15m,-1S	+1S	16	—		R	R-14
47													S	24
48	↓												T	4
43	HRHS												U	19
44	MF												V	18
56	HRHS			↓						↓			W	29
49	BX	↓	↓	20	↓	↓	↓ ↓	↓ ↓	↓	5	↓	↓	QQ	TR-B
13857	TRI-X	0	0	11	MIRROR	2°-50'	115AC 24DC	-15m,-1S	+1S	29	—	—	Apron	R-12
59	HRHS													17
60	ECN													5
58	TRI-X	↓	↓	↓	↓	↓	↓ ↓	↓ ↓	↓	↓	↓	↓	↓	6

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EDGERTON, GERMESHAUSEN & GRIER, INC.

CAMERA DATA SHEET

4-248 ¼

TEST TS-8 DATE 6-5-52 STAs. 2-356

TRUCK 1 & TRAILER 4

REMARKS & NOTES	PURPOSE	~FR./SEC.	CAMERA NO.	CAMERA SERIAL	CAMERA MAG.	TIME OPER.	LENS FOC. LGH.	LENS SERIAL
	SHOCK	650	E-17	1496			152	RC273
	"	"	20	1525			"	RC813
	YIELD	3000	12	1512			102	RY510
			18	1517			"	ET415
			7	1443			63	ET1229
			24	1522			"	RC539
	STEM	650	27	1514			25	RY189
	COLOR	400	1	1464			"	RY183
ND 0,0.5,1.0,1.5,2.0,3.0	LIGHT	80 1/SEC	GR-4	670			—	—
W25 + BAIRD #7-20798 6490±125A								
RAISE FRONT	SHOCK	100	MH-1	748			100	BF9465
	"		4	745				BF8525
	CLOUD		8	744				BF9463
	"		6	746			25	VF983
	YIELD		R-8	8		13,650 μs	480	773944
	"		10	10		8300		3961
			26	26		9.8		4696
			31	31		27.5		3948
			9	9		95		4694
			33	33		403		3950
	GUN BURSTS 4	100	MH-7	742			400	52236
	3		3	734				52237
	1 & 2		2	747				52238

[redacted]

EDGERTON, GERMESHAUSEN & GRIER, INC.

CAMERA DATA SHEET 4-248 $

TEST TS-8 DATE 6-5-52 STAs. 2-356
TRUCK 1 & TRAILER 4

PERF.	EMULS.	FILTERS		APER.	AIMING		POWER	TIMING		MARKERS, SERIALS			RACK	CAM
CODE		ND	COLOR	SET.	HORIZ.	VERT.		ON	OFF	FM.	VEL.	ZERO	POS.	NO.
13874	MF	1	12	8	1°42'L	1°36'	120DC SHUNT	-1.5S	SELF	23	200-4	4	A	E-17
75		0.5	47		3°24'L		"				10	10	B	20
00		0	12		0°00'		40/80				9	9	C	12
01		1		5.6							4	4	D	18
02		0		8							10	10	E	7
03		1		5.6							9	9	F	24
73				"		4°00'	SHUNT				4	4	G	27
13	ECN		0	8		"	"				4	4	L	1
26	LIN-PAN	STEP #14	25+INT	—		LEVEL		-1.0S		—	9	—	K	GR-4
13882	MF	0	12	5.6 60°	0°00'	+2°00'	120DC	-15S	+30S	—	100-6	—	PP	MH-1
81	"	"	"	8 45°	5°22'L						1		O	4
19	ECN	1	0	4 15°	0°00'						1		N	8
20	"	0		4 170°		12°00'					6		P	6
53	TRI-X			11		1°36'	115AC 24DC	-15m, -1S	+1S	10	—		R	R-8
54	"									24			S	10
45	HRHS									10			T	26
46	"									24			U	31
41	MF									"			V	9
42	"									10			W	33
13872	SXX	0	0	6.3 60°	13°28'L	15°11'	115AC	-15S	+20S	—	100-4	—	A	MH-7
71	MF			6.3 170°	9°30'L	12°10'							B	3
70	"			6.3 30°	5°29'L	7°8'							C	2

[redacted]

APPENDIX B

FILM LISTING "BLAST STUDIES ON OPERATION TUMBLER-SNAPPER"

A sound movie concerned primarily with the study of blast effects on Tumbler-Snapper has been made and distributed. Table B.1 lists films contained in this movie in the order of their appearance.

In addition to the films listed in Table B.1, this movie contains Rapatronic photographs and descriptive footage shot especially for this picture.

[redacted]

Table B.1 — FILMS CONTAINED IN SOUND MOVIE
"BLAST EFFECTS ON TUMBLER-SNAPPER"

NAME | DATE | JOB NO.

Film #	Shot #	Station	Nominal Speed
13021	1	F-362	100 FR/SEC.
13222	3	T-362	100
13206	3	T-361	3000
13381	4	"	100
13321	4	T-362	100
13383	4	"	100
13071	1	F-361	100
13121	2	T-362	100
13273	3	T-360	500
13275	3	"	500
13276	3	"	500
13277	3	"	500
13278	3	"	500
13280	3	T-361	500
13366	4	376	36
13321 (repeat)	4	T-362	100
13373	4	T-360	500
13374	4	"	500
13085 pre	1	F-363	36
13086 post	1	"	36
13091 pre	1	F-366	36
13092 post	1	"	36
13094	1	F-367	36
13096	1	F-368	36
13098	1	"	36
13286 pre	3	363	36
13285 post	3	"	36
13198	2	T-375	300
13288 pre	3	364	36
13287 post	3	"	36
13290 pre	3	365	36
13289 post	3	"	36
13269	3	T-248	36
13292 pre	3	366	36
13291 post	3	"	36
13296	3	367	36
13298 pre	3	368	36
13297 post	3	"	36
13299	3	"	36
13220	3	T-362	100

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BOSTON, 15, MASSACHUSETTS

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APPENDIX C

CAMERA-STATION LAYOUTS, TS 1 TO 8

[redacted]

Table C.1 — CAMERA-STATION SUMMARY, TUMBLER-SNAPPER

			NAME			DATE		JOB NO.
			COORDINATES					
Shot #	Area	Photo Station #	N	E	Elev (FT re sea level)	Photo Vehicle		
1	FF	F-360	738,350	713,000	3162	Truck #1		
		F-361	738,330	711,000	3133	Trailer #4		
		F-362	745,826	703,937	3088	Truck #2 &	Trailer #5	
2, 3 + 4	7	7-360	845,192	701,169	4394	Truck #1		
		7-361	839,282	700,134	4259	Truck #2 &	Trailer #4	
		7-362	835,898	686,857	4018	Trailer #		
5	1	1-355	831,633	672,359	4103	Truck #1 &	Trailer #4	
		1-356	846,551	671,736	4163	Truck 2	" 5	
6	4	4-355	846,580	671,736	4163	Truck 2 +	Trailer 5	
		4-356	863,886	668,746	4283	" 1	" 4	
7	3	3-355	829,561	695,882	4019	Truck 1 +	Trailer 4	
		5-356	844,491	695,882	4236	" 2	" 5	
8	2	2-355	863,916	668,730	4283	Truck 1 +	Trailer 4	
		2-356	878,577	665,909	4507	" 2	" 5	

		Ground Zero Coordinates		
Shot #	Area	N	E	Z (Burst Ht re Ground)
1	FF	746,372	714,067	793
2	7	850,291	688,769	1109
3	7	850,344	688,561	3447
4	7	850,284	688,532	1040
5	1	838,780	664,589	300 (Tower)
6	4	854,234	664,464	300 "
7	3	837,026	688,416	300 "
8	2	869,836	659,989	300 "

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[redacted]

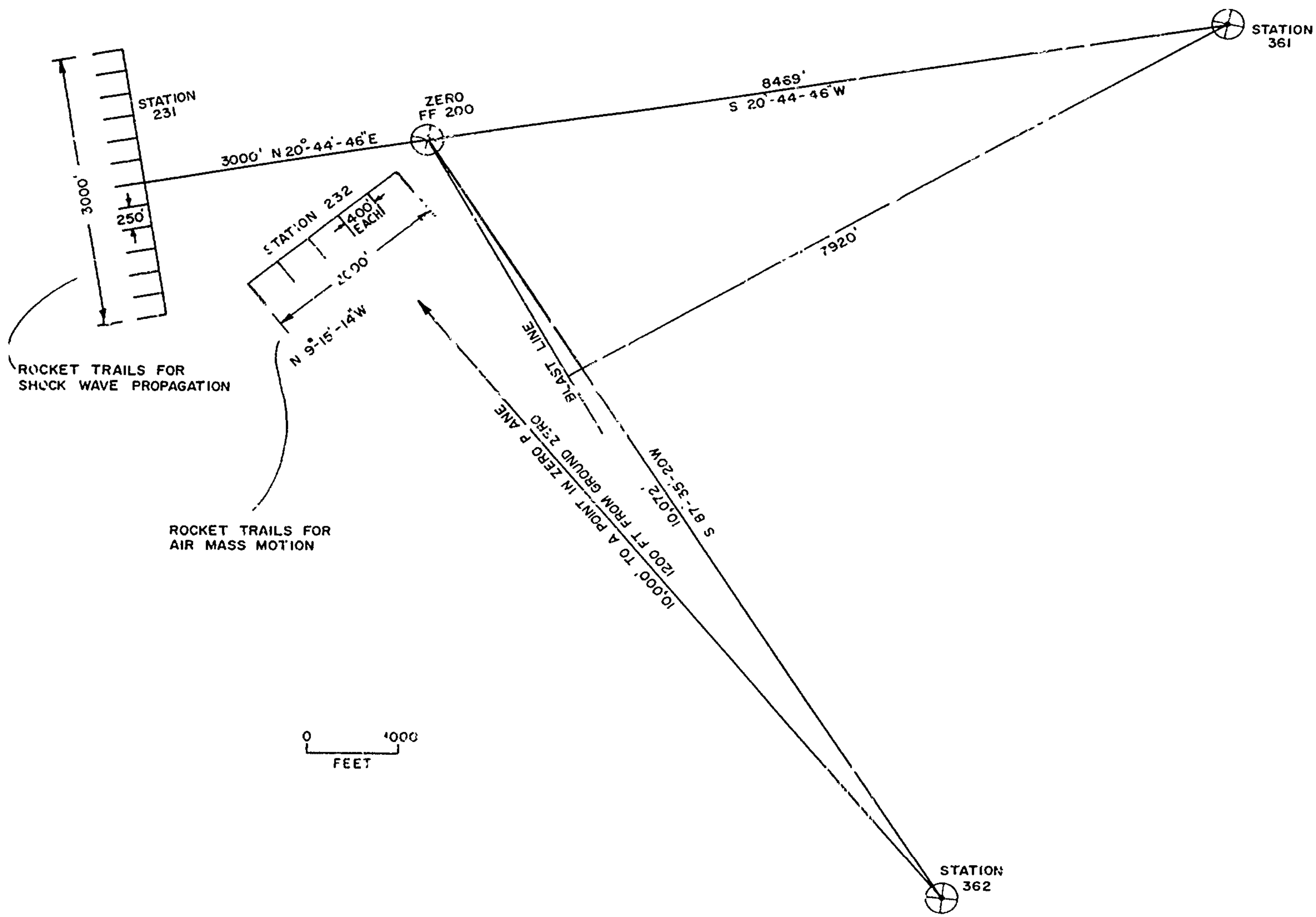

Fig. C.1—Area F layout, TS-1. Note NOL rocket stations and EG&G camera stations.

[redacted]

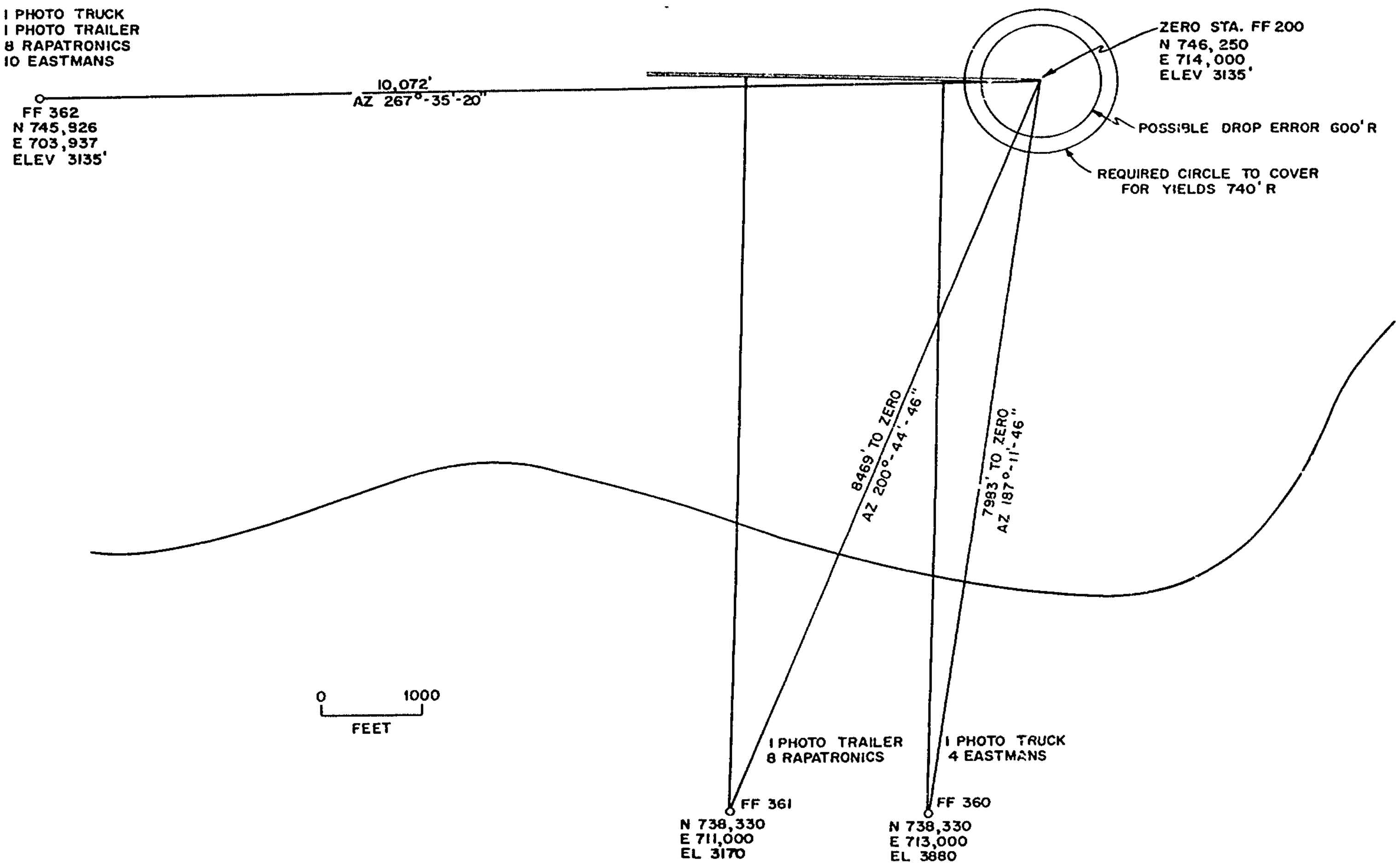

Fig. C.2—Photostation layout for yield, TS-1.

[redacted]

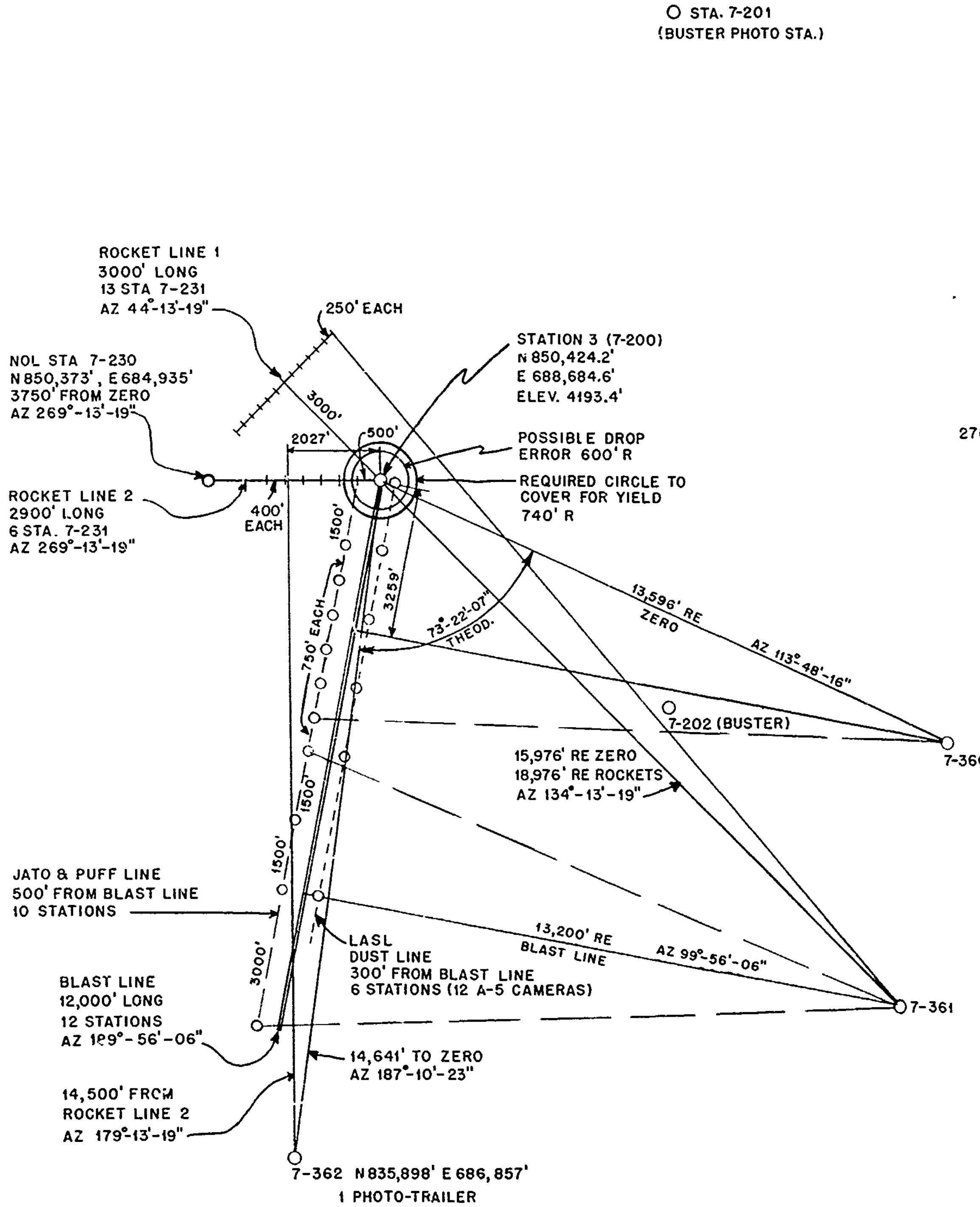

Fig. C.3—Photostation layout, TS-2.

[redacted]

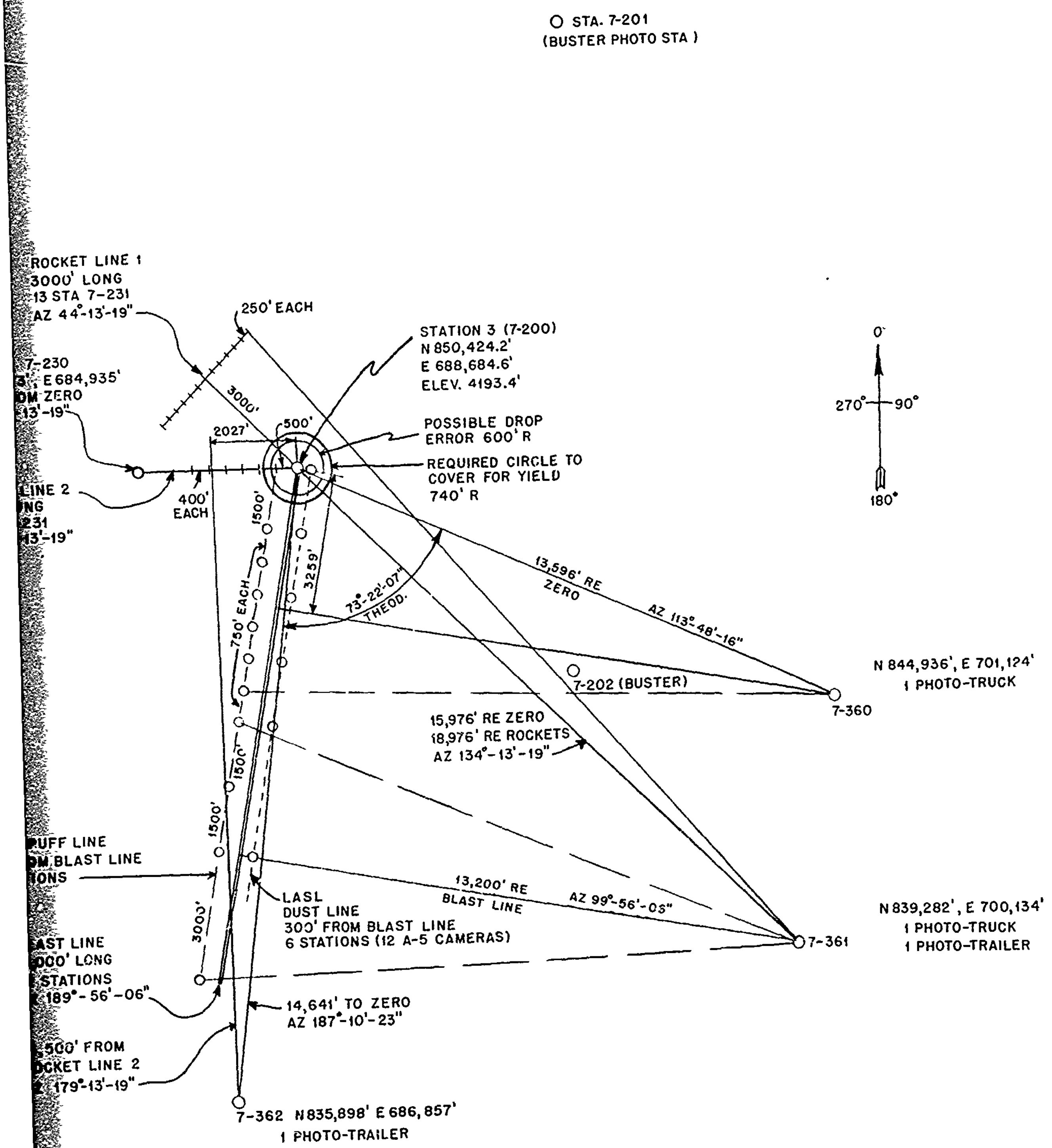

Fig. C.3—Photostation layout, TS-2.

[redacted]

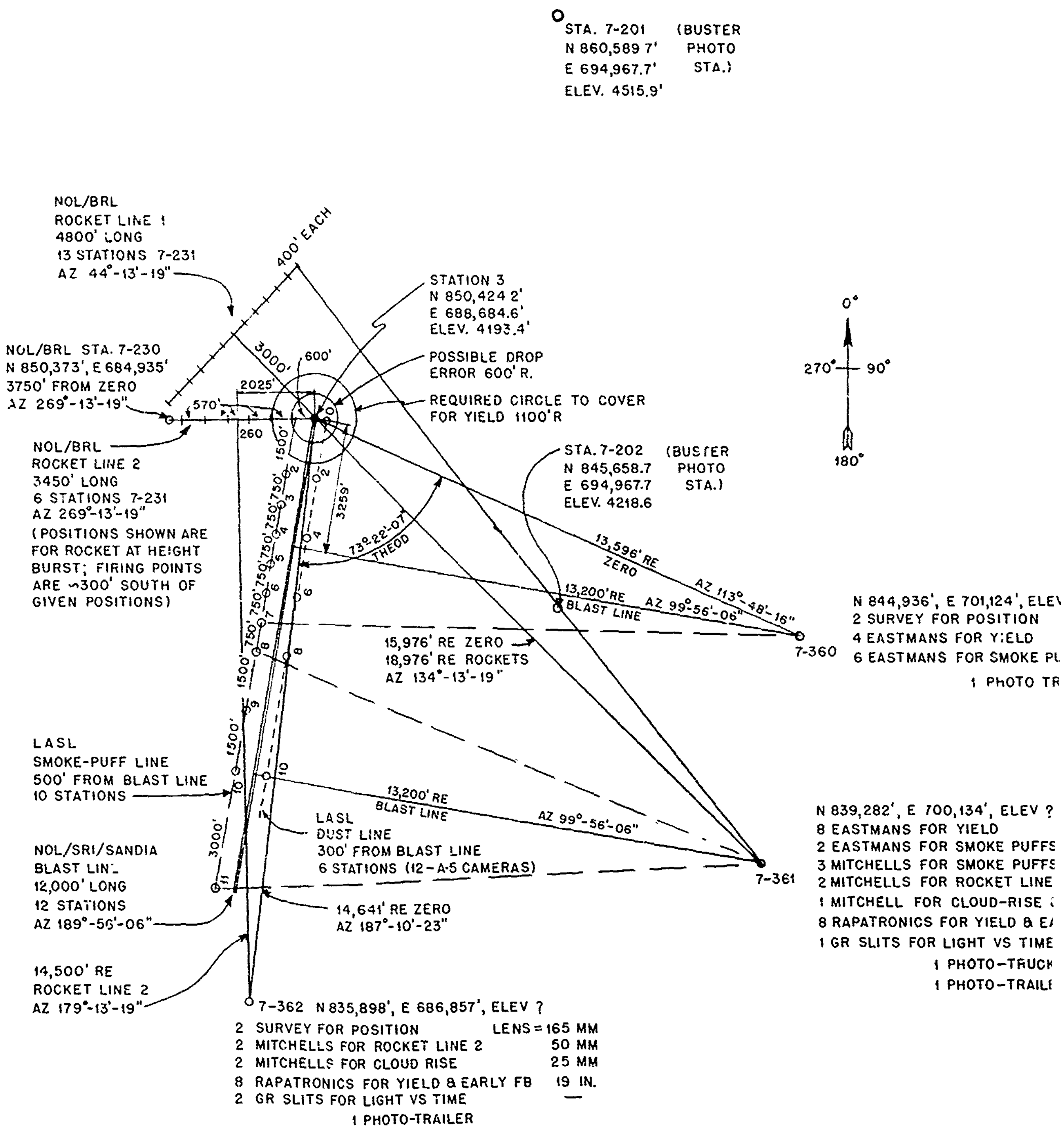

Fig. C.4—Photostation layout, TS 3 and 4.

[redacted]

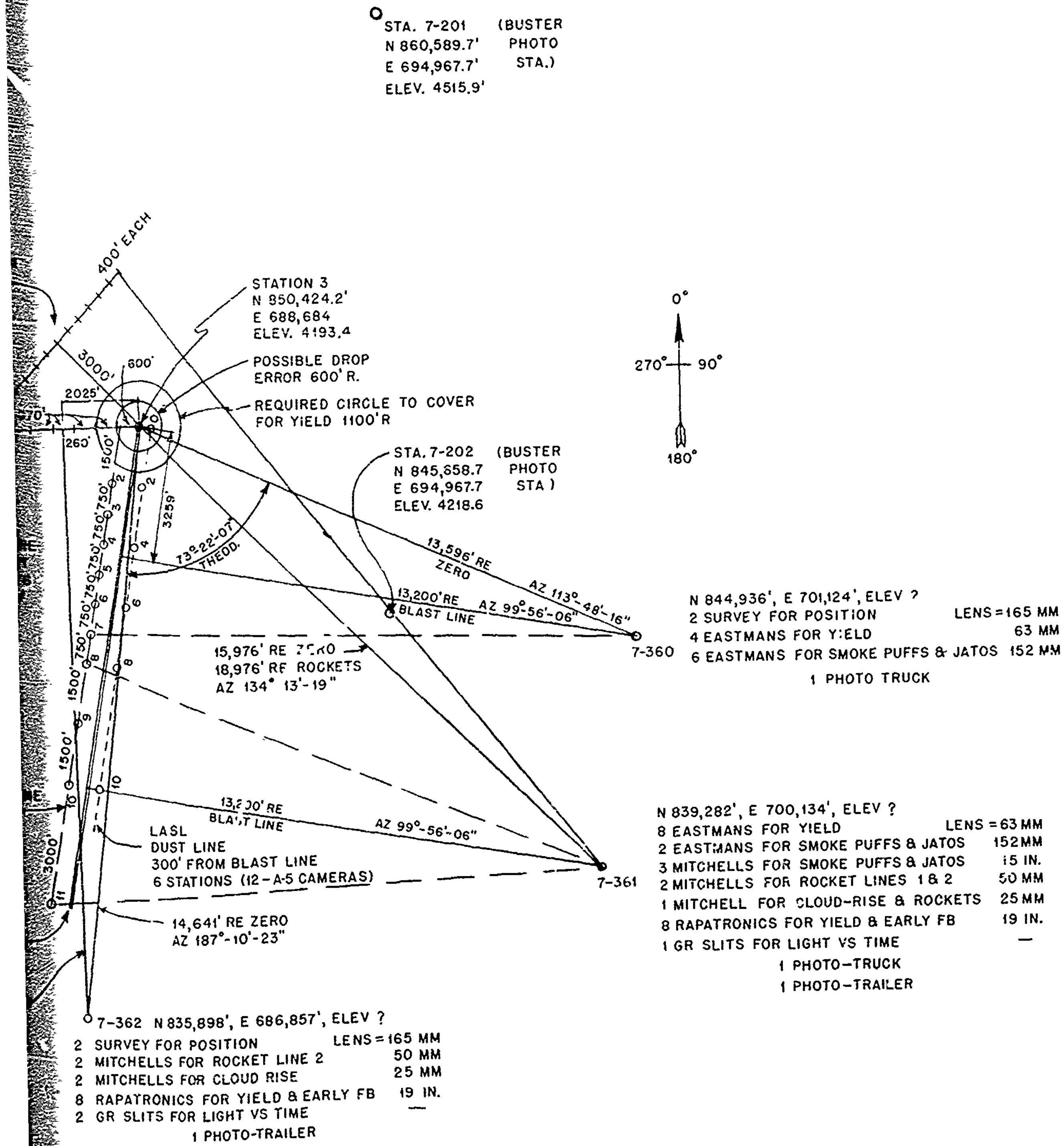

Fig. C.4—Photostation layout, TS 3 and 4.

[redacted]

2

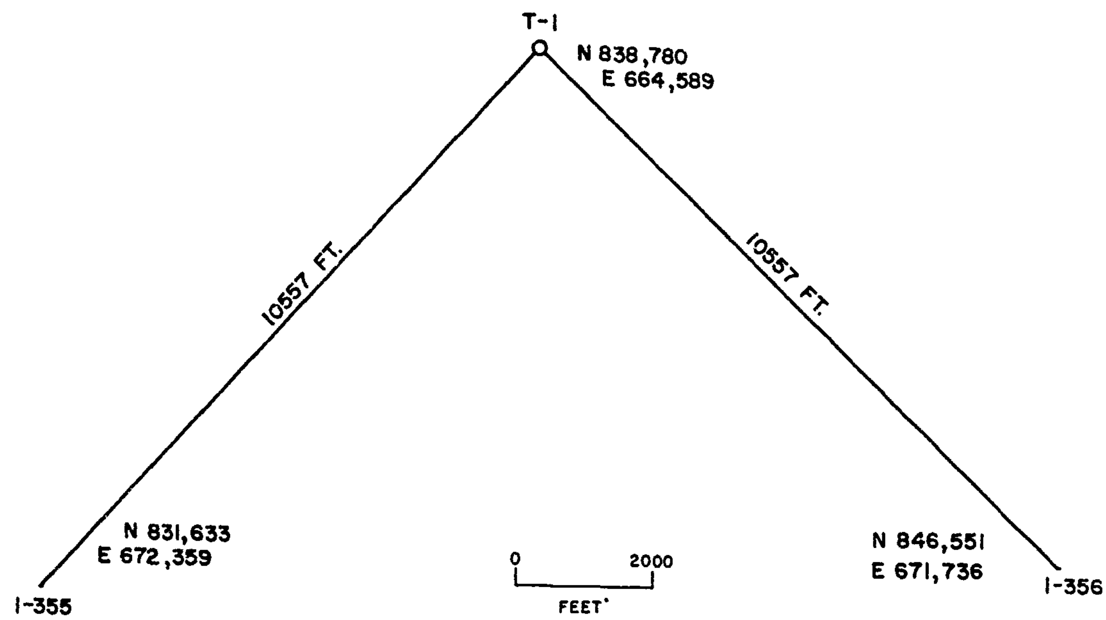

Fig. C.5—Photostation layout, TS-5.

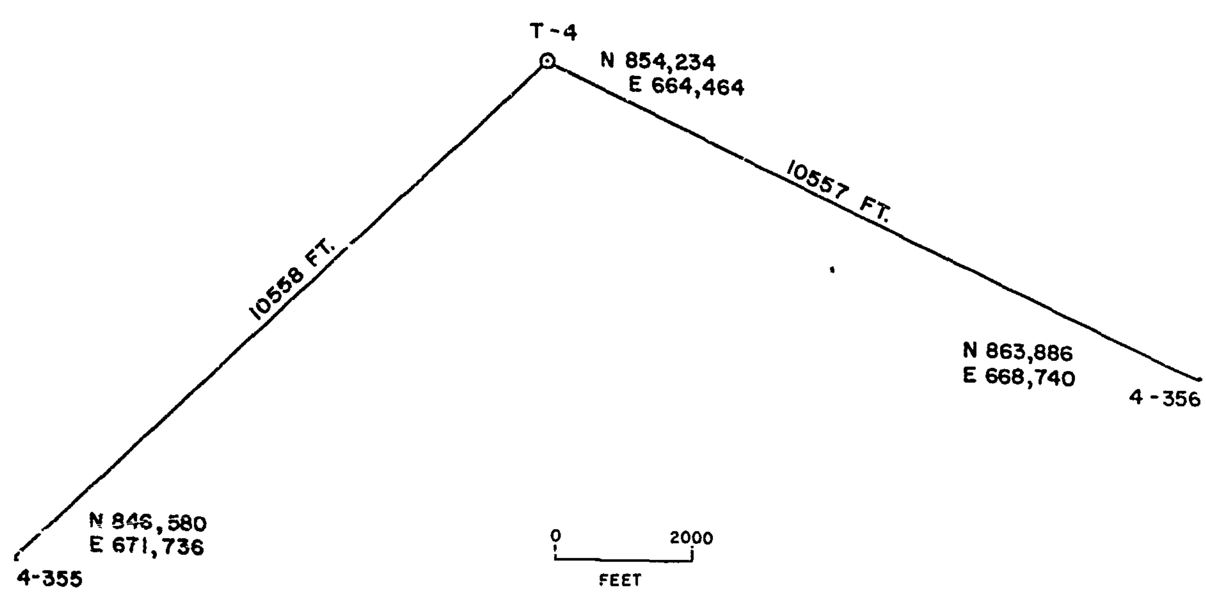

Fig. C.6—Photostation layout, TS-6.

[redacted]

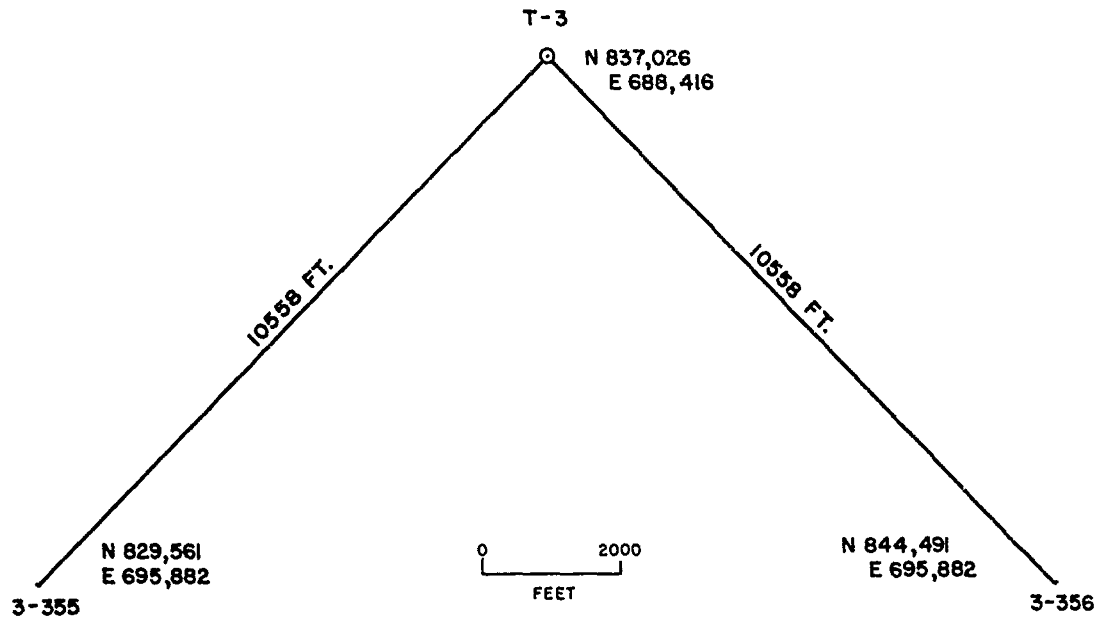

Fig. C.7—Photostation layout, TS-7.

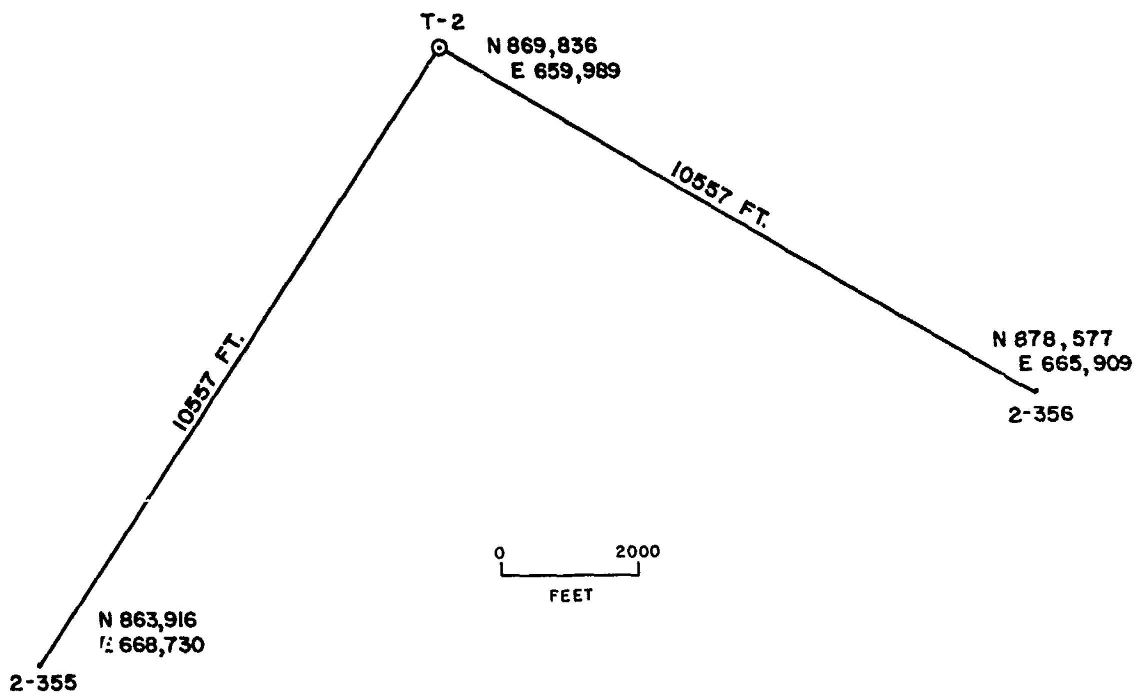

Fig. C.8—Photostation layout, TS-8.

[redacted]

APPENDIX D

CALIBRATION OF EFFECTIVE FOCAL LENGTH WITH COLLIMATOR AND PRISM

This section describes the collimator-prism technique which was used to calibrate the effective focal lengths of the lens-camera combinations. The collimator with its single target and prism essentially replaces two targets at optical infinity separated by a known angle. Figure D.1 illustrates the geometrical properties and nomenclature of the system.

In the ideal case it is necessary that the deviated collimator beam be symmetrical about the photographic axis of the lens. For this case we may write

$$r' = f\,(\tan \eta/2 + \tan \eta/2) = 2f \tan \eta/2 \qquad \text{(D.1)}$$

where r' = the distance between target images on the film
f = the effective focal length of the camera-lens system
$\eta/2$ = half the total deviation angle of the prism

In the actual case this perfect optical alignment is not possible. The equation of the inner orientation must be written as

$$\begin{aligned} r' &= f(\tan \eta/2 + \mu + \tan \eta/2 - \mu) \\ &= f[\tan \eta/2 + \tan \eta/2 + \mu(\sec^2 \eta/2 - \sec^2 \eta/2)] \qquad \text{(D.2)} \\ &= 2f \tan \eta/2 \end{aligned}$$

when μ is small with respect to $\eta/2$.

If reasonable care is taken in setting up the instrument, i.e., if the two collimator images are centered making μ small with respect to $\eta/2$, then Eq. D.2 breaks down into the simpler form of Eq. D.1.

For the calculation of focal length it is only necessary to measure the distance between the two images of the collimator target on the film and to divide by the parameter ($2 \tan \eta/2$) which is a constant of the particular prism being used. Before measurement the film should be conditioned for 12 to 24 hr in an atmosphere of approximately 70°F and 60 per cent relative humidity. The reason for this is to try to eliminate any effects of differential film shrinkage, that is, the difference in the shrinkage of the calibration films and the shot films. The shot films are conditioned in this same atmosphere.

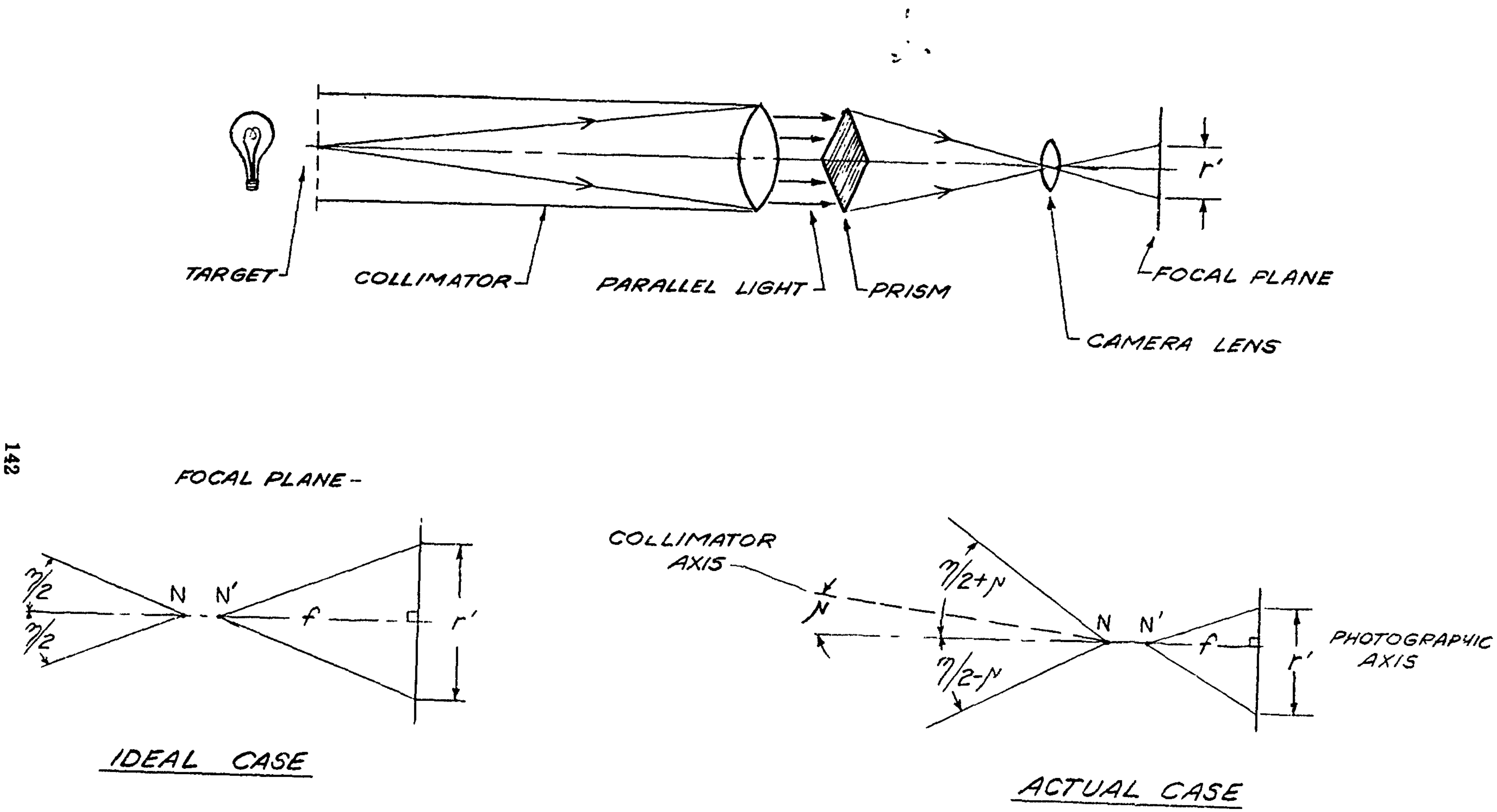

Fig. D.1—Geometrical properties and nomenclature of collimator-prism system.

APPENDIX E

METEOROLOGICAL DATA, TUMBLER-SNAPPER

Shot	Date	Time, PST	Temp., °C	Pressure, mb	Relative humidity, %	Air density	Velocity of sound, meters/~~μsec~~ msec
1	4-1-52	0900:07.5	13.6	888.5	30	1.066	0.3397
2	4-15-52	0929:57.05	9.1	842	30	1.049	0.3370
3	4-22-52	0930:10.02	7.6	770	47	0.9536	0.3361
4	5-1-52	0829:59.1	15.0	845	50	1.018	0.3406
5	5-7-52	0414:59.25	16.6	858	37	1.029	0.3416
6	5-25-52	0359:59.6	19.4	858	41	1.021	0.3433
7	6-1-52	0354:59.8	13.2	865	48.1	1.040	0.3395
8	6-5-52	0355:00.3	20.6	856.5	50.4	1.010	0.3440

[redacted]

APPENDIX F

RAPATRONIC TOWER PHOTOGRAPHY, TS 5 TO 8

Figures F.1 to F.8 are early fireball photographs which create an interesting study, all to the same scale, of the growth of four detonations, TS 5 to 8.

[redacted]

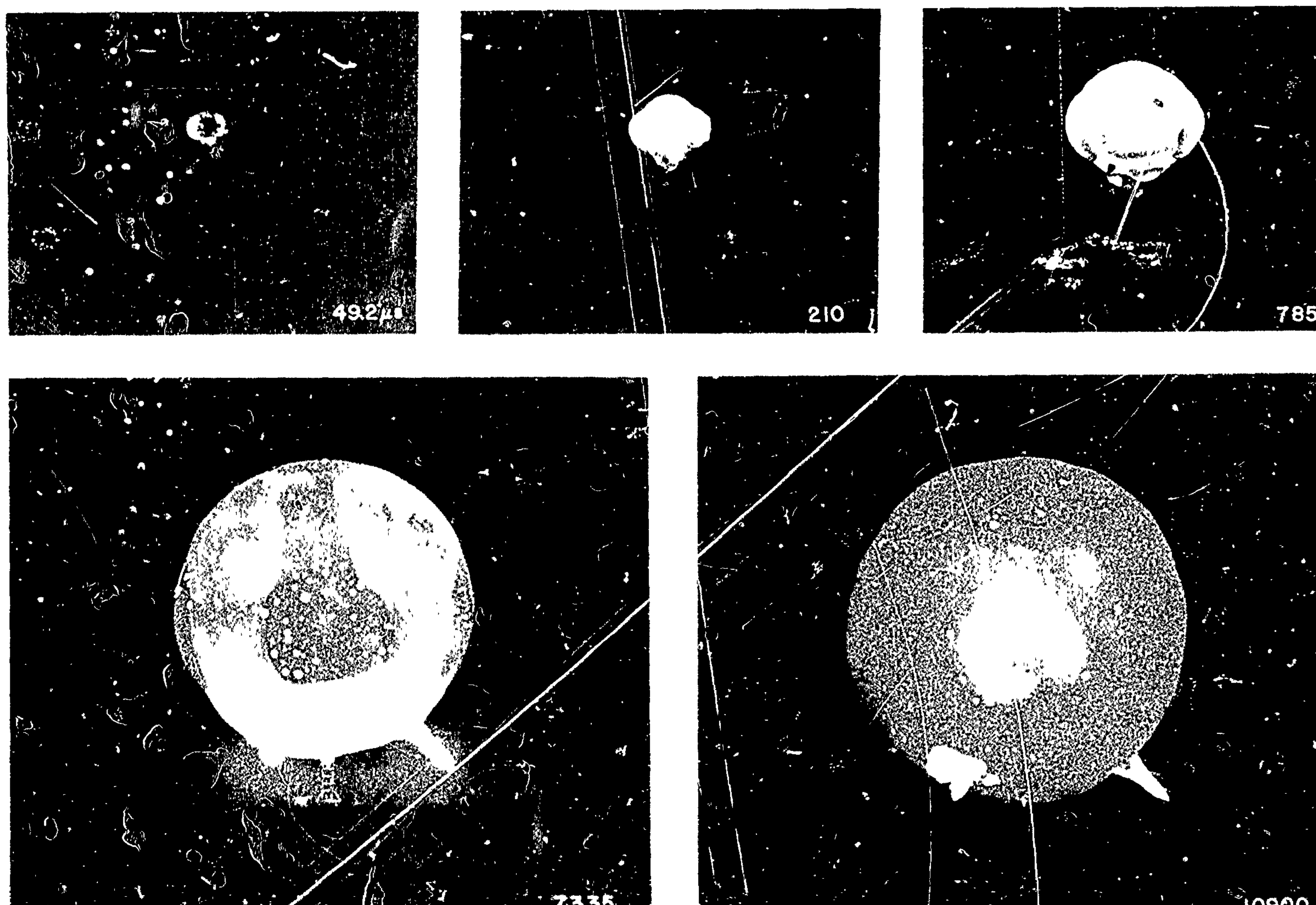

Fig. F 1—Fireball photograph, TS-5, 7 May 1952. Camera 2 miles northeast.

[redacted]

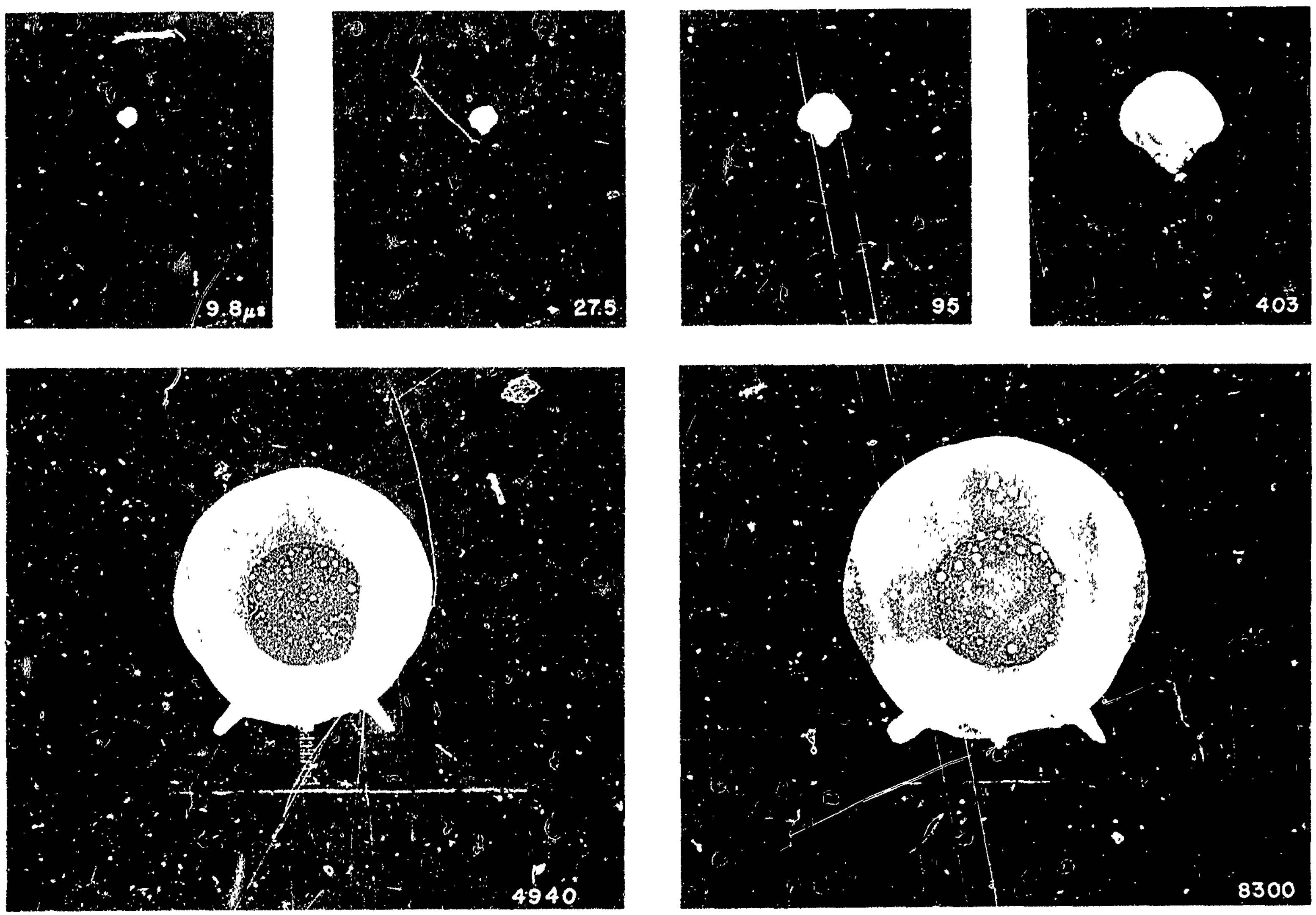

Fig. F.2—Fireball photograph, TS-5, 7 May 1952. Camera 2 miles southeast.

[redacted]

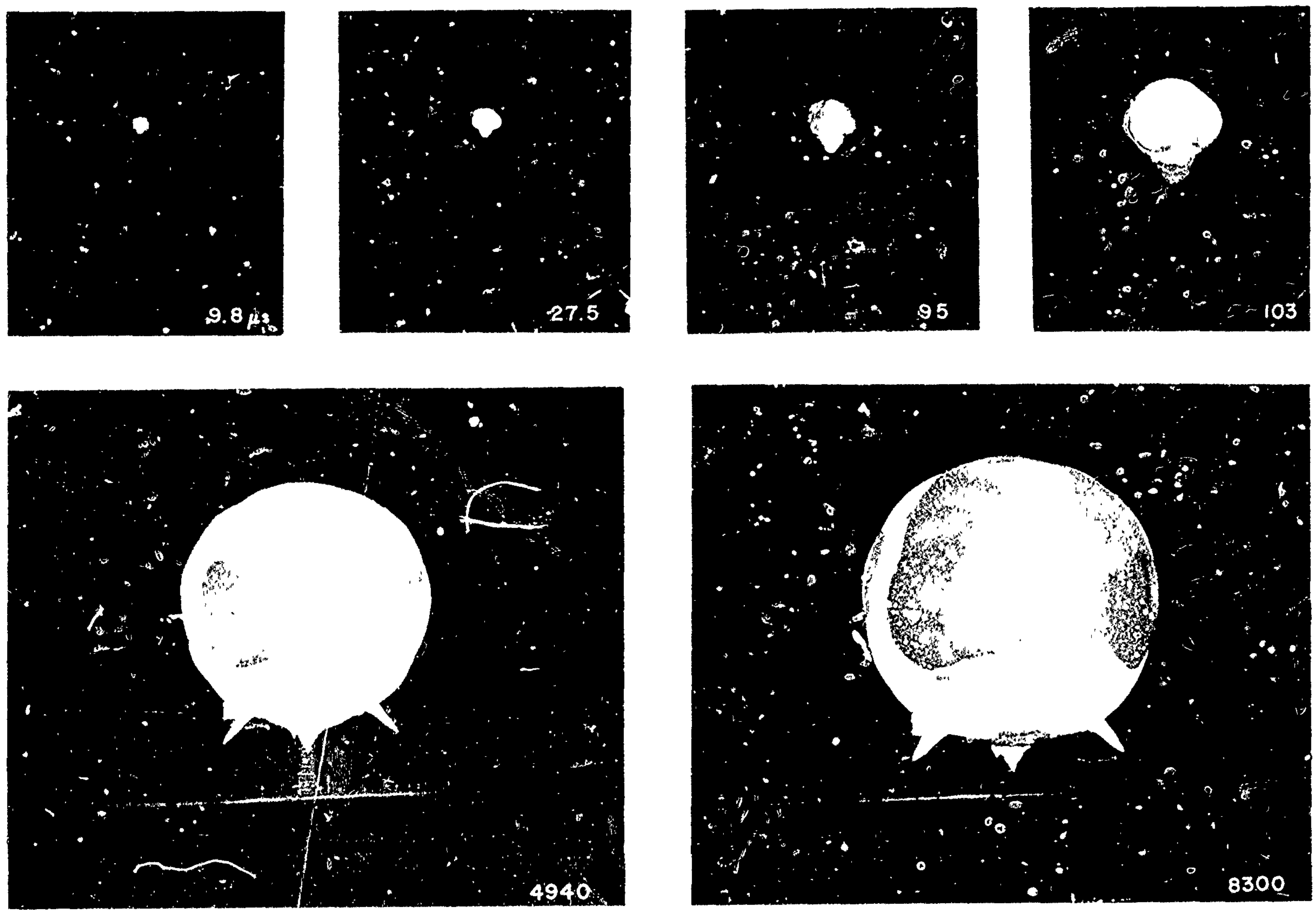

Fig. F.3—Fireball photograph, TS-6, 25 May 1952. Camera 2 miles northeast.

[redacted]

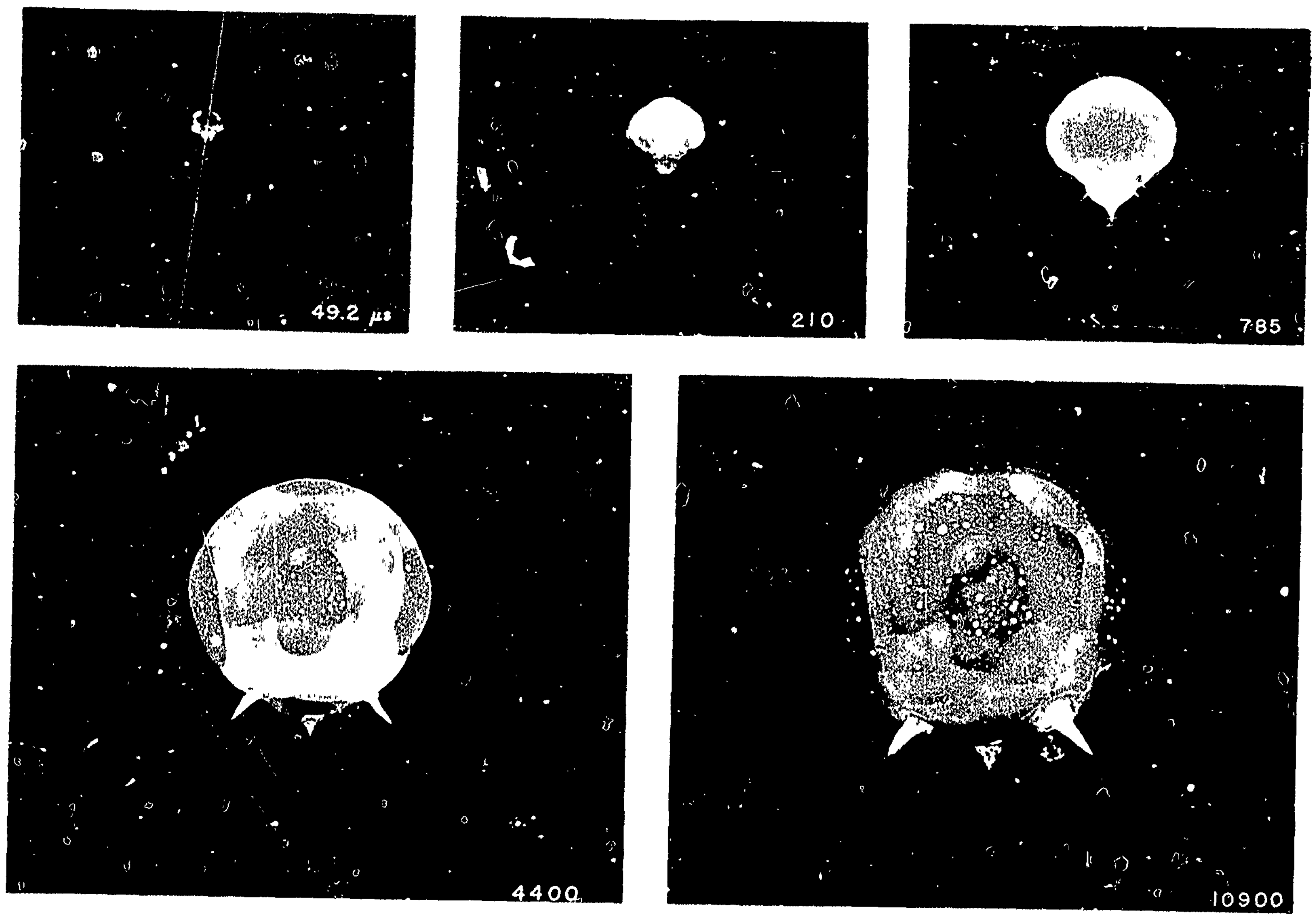

Fig. F.4—Fireball photograph, TS-6, 25 May 1952. Camera 2 miles southeast.

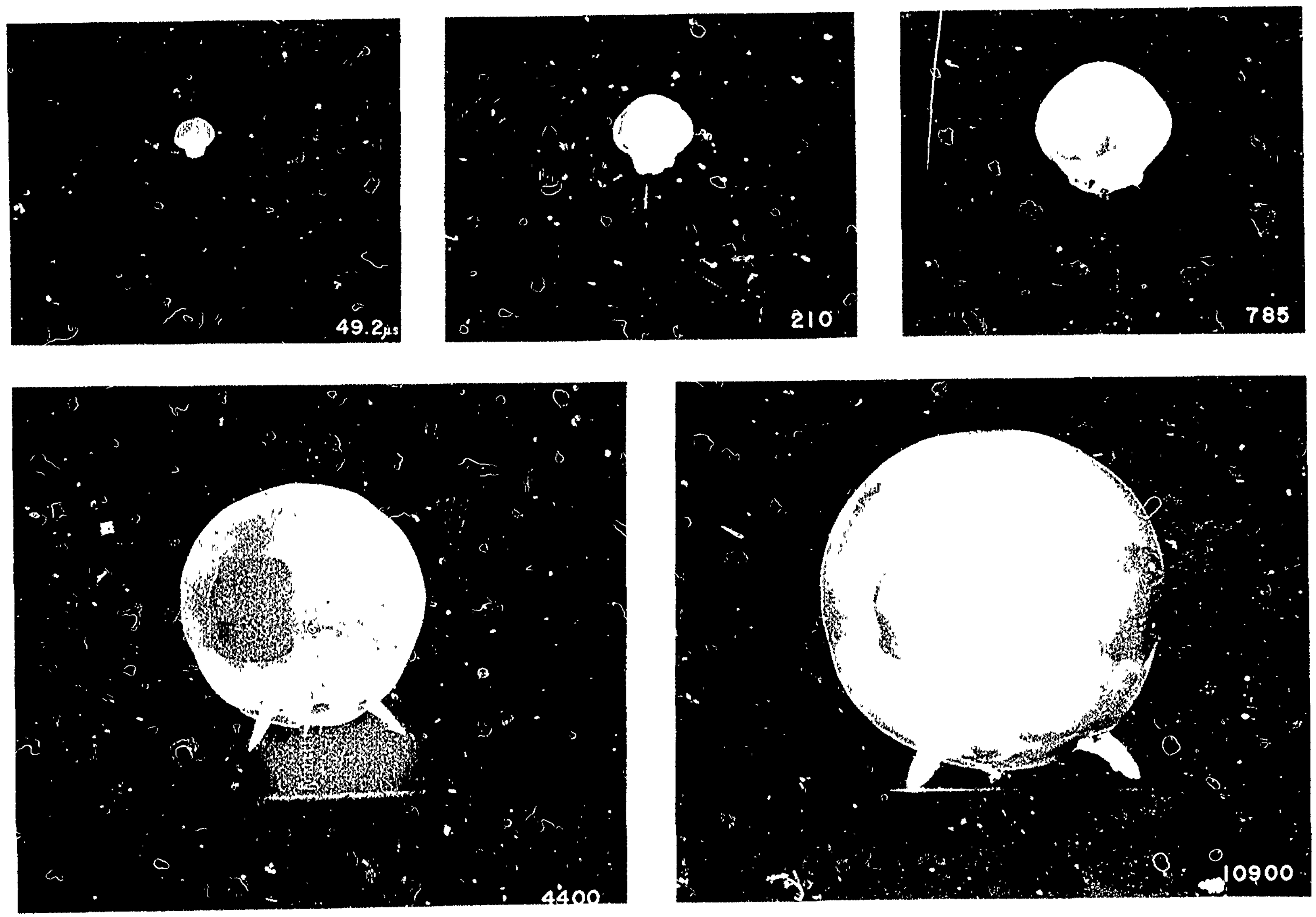

Fig. F.5—Fireball photograph, TS-7, 1 June 1952. Camera 2 miles northeast.

[redacted]

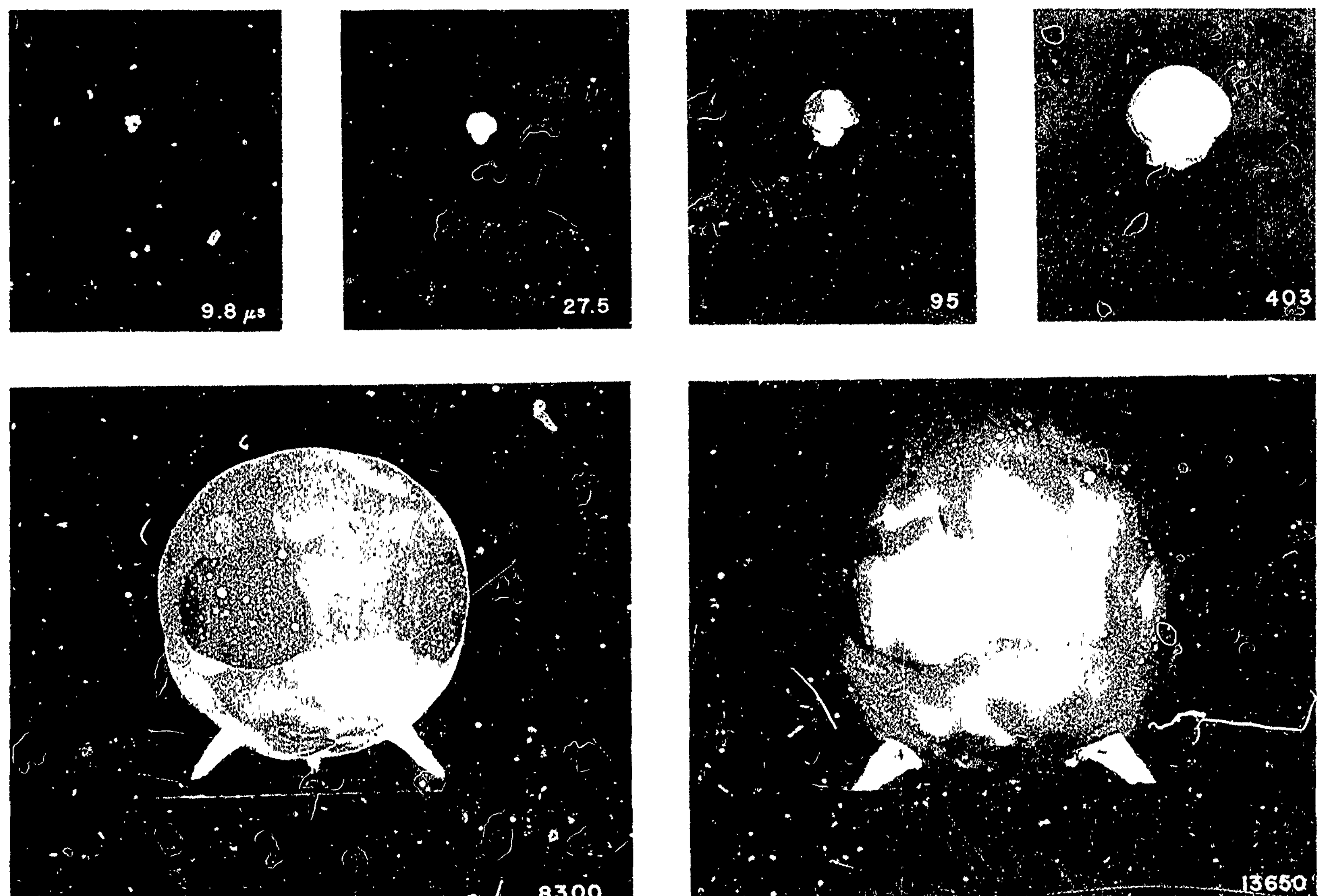

Fig. F.6—Fireball photograph, TS-7, 1 June 1952. Camera 2 miles southeast.

[redacted]

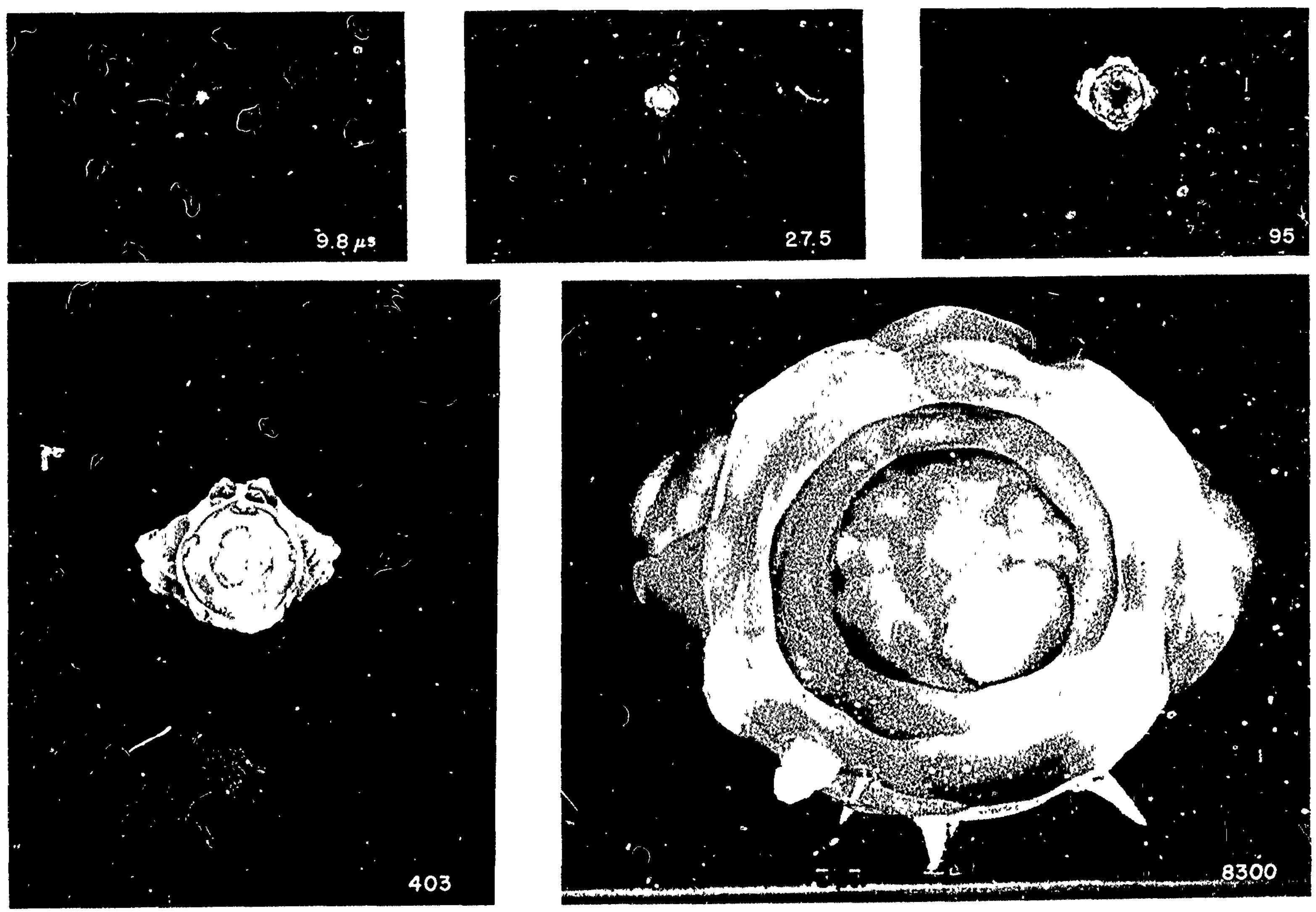

Fig. F.7—Fireball photograph, TS-8, 5 June 1952. Camera 2 miles northeast.

[redacted]

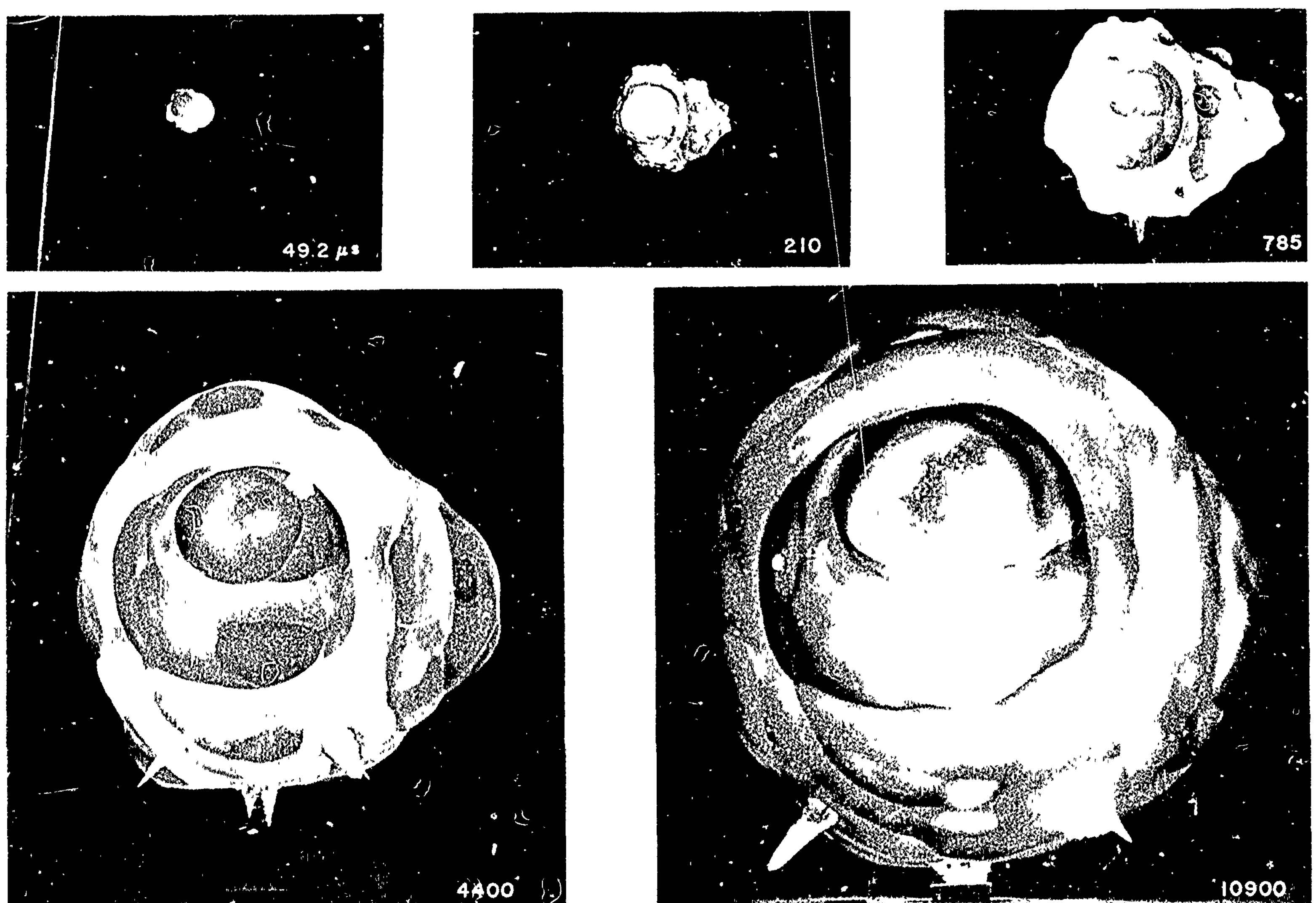

Fig. F.8—Fireball photograph, TS-8, 5 June 1952. Camera 2 miles southeast.

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University of California Radiation Laboratory, PO Box 808, Livermore, Calif., ATTN: Margaret Folden Edlund	51
Weapon Data Section, Technical Information Service, Oak Ridge, Tenn.	52
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